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PREDICTORS OF CHOLEDOCHOLITHIASIS IN PATIENTS PRESENTING WITH CHOLECYSTITIS

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ABBREVIATIONS

CBD	:	Common Bile Duct
CT	:	Computed Tomography
ERCP	:	Endoscopic Retrograde Cholangiopancreatography
USG	:	Ultrasonography
MRCP	:	Magnetic Resonance Cholangiopancreatography
ALP	:	Alkaline Phosphatase
SGOT	:	Serum Glutamic-Oxaloacetic Transaminase
SGPT	:	Serum Glutamic-Pyruvic Transaminase
TLC	:	Total Leucocyte Count
GGTP	:	Gamma-Glutamyl Transferase
PLT	:	Platelet Count
PTINR	:	Prothrombin Time International Normalized Ratio
LAP	:	Laparoscopy
IHBRD	:	Intrahepatic Bile Duct Radial Dilatation
BMI	:	Body Mass Index
OCBDE	:	Open Common Bile Duct Exploration
LCBDE	:	Laparoscopic Common Bile Duct Exploration

INDEX

CONTENT		PAGE NO.
1	INTRODUCTION	1
2	RATIONALE OF STUDY	6
3	AIM AND OBJECTIVES	7
4	REVIEW OF LITERATURE	8
5	MATERIALS AND METHODS	34
6	RESULTS	38
7	DISCUSSION	54
8	SUMMARY	57
9	CONCLUSION	58
10	REFERENCES	59
11	ANNEXURES	63

ABSTRACT

Introduction:

Cholecystitis is a common gallbladder disease that often necessitates surgical intervention, particularly cholecystectomy. Early detection and management of choledocholithiasis in cholecystitis patients can significantly enhance treatment outcomes and reduce the need for more invasive procedures. This study aims to develop a predictive model for early detection of choledocholithiasis using clinical, biochemical, and radiological findings.

Aim and Objectives:

The primary aim of this study is to predict cases of choledocholithiasis preoperatively in patients presenting with cholecystitis. Objectives include studying clinical findings, biochemical values, and radiological findings in these patients and developing an easily applicable algorithm for early diagnosis.

Methodology:

This hospital-based observational study was conducted at the Department of General Surgery, Santosh Medical College & Hospital, Ghaziabad. It included 196 patients diagnosed preoperatively with cholecystitis, aged 18 to 60 years. Exclusion criteria encompassed asymptomatic cholelithiasis, gallstone-induced pancreatitis, acalculous cholecystitis, gall bladder malignancy, and patient refusal to participate. Data collection involved history taking, clinical examinations, radiological investigations, and laboratory tests. Data analysis was performed using Stata MP-17, focusing on parametric and non-parametric tests based on data distribution.

Results:

Choledocholithiasis was identified in 20.9% of patients with acute cholecystitis, aligning with global estimates and underscoring the need for routine CBD evaluation. Risk factors included age over 40, female gender, and comorbidities like diabetes and hypertension. Common findings included gallbladder distension, multiple gallstones, and CBD dilatation, with single CBD stones being more prevalent. Elevated liver enzymes and GGTP levels, particularly when correlated with CBD diameter, proved useful for early detection, though a multimodal diagnostic approach remains essential due to limited

correlation with imaging. While open CBD exploration was the primary intervention, ERCP was effective in selected cases, supporting individualized management strategies.

Conclusion:

Choledocholithiasis is a frequent and clinically significant finding among patients with acute cholecystitis. Early identification through integrated clinical, biochemical, and radiological evaluation is critical for optimizing management and preventing complications. The study also highlights the impact of age, gender, comorbidities, and imaging findings on disease presentation and outcomes, underscoring the need for individualized patient assessment and tailored intervention strategies.

Keywords:

Cholecystitis, Choledocholithiasis, Predictive Model, Clinical Findings, Biochemical Markers, Radiological Imaging, Laparoscopic Cholecystectomy, Hospital-Based Observational Study, Diagnostic Algorithm, Surgical Outcomes.

INTRODUCTION

Cholecystitis is an inflammatory condition of the gallbladder, most commonly resulting from gallstone obstruction of the cystic duct. This blockage impedes bile flow, leading to inflammation and, in some cases, secondary infection. While uncomplicated cholecystitis generally carries an excellent prognosis and is effectively managed with cholecystectomy—allowing patients to resume normal activities—complications such as gallbladder perforation, gangrene, or sepsis can significantly worsen outcomes and require urgent intervention. Globally, cholecystitis accounts for approximately 3–10%[1] of cases of abdominal pain. In the United States alone, it was responsible for an estimated 651,829 emergency department visits and 389,180[2] hospital admissions in 2015. Although gallstones are prevalent, only 1–2% of individuals with gallstones become symptomatic each year. The incidence of cholecystitis closely parallels gallstone formation, highlighting the importance of early identification and preventive strategies, particularly in high-risk populations influenced by dietary habits, genetic predisposition, and overall health status.

Risk factors for calculous cholecystitis include female sex, obesity, rapid weight loss, oral contraceptive use, pregnancy, and aging. Acalculous cholecystitis, occurring without gallstones, is linked to biliary stasis due to critical illness, major surgery, trauma, burns, prolonged fasting, or long-term parenteral nutrition. Additional causes include myocardial infarction, sickle cell disease, salmonella infections, diabetes, and AIDS.

Acute cholecystitis presents with fever, right upper quadrant pain, nausea, and vomiting. Physical examination often reveals tenderness, guarding, and a positive Murphy's sign. Diagnostic grading systems, including the Tokyo Guidelines and the American Association for the Surgery of Trauma (AAST) Emergency General Surgery (EGS) framework, assess severity, categorizing cases from localized inflammation to severe complications like pericholecystic abscess, Bili enteric fistula, and peritonitis. Laboratory markers such as elevated alkaline phosphatase, bilirubin, transaminase levels, and leucocytosis support diagnosis. Profound jaundice is rare but may indicate cholangitis or Mirizzi syndrome.

Transabdominal ultrasonography is the preferred diagnostic tool, with a sensitivity of 85% and specificity of 95%[3]. It detects gallstones, pericholecystic fluid, and gallbladder

wall thickening, along with a sonographic Murphy's sign. In uncertain cases, a HIDA scan confirms acute cholecystitis by assessing cystic duct obstruction. While CT scans reveal similar findings, they are less sensitive than ultrasound but useful for identifying complications such as emphysematous cholecystitis.

Cholecystectomy is the standard treatment for symptomatic gallstones and acute or chronic cholecystitis, preventing complications like pancreatitis and gallbladder cancer. Laparoscopic cholecystectomy, the preferred minimally invasive approach, offers benefits like reduced postoperative pain and faster recovery. Open cholecystectomy, requiring a larger incision, is reserved for cases where laparoscopic surgery is not feasible due to complications. This surgery significantly improves the quality of life by preventing recurrent, potentially life-threatening conditions.

Choledocholithiasis is the presence of gallstones within the common bile duct (CBD), which can obstruct bile flow and result in serious complications such as jaundice, cholangitis, and pancreatitis. It is classified into primary choledocholithiasis, where stones originate within the CBD due to bile stasis, infection, or abnormal bile composition, and secondary choledocholithiasis, the more prevalent type, where gallstones migrate from the gallbladder into the CBD. The primary etiological factors include gallbladder stones, biliary stasis due to strictures or tumours, infections (bacterial or parasitic), and previous cholecystectomy. Risk factors encompass female sex, advanced age, obesity, rapid weight loss, high-fat diets, diabetes mellitus, haemolytic disorders, and a history of biliary tract infections or gallbladder disease. Clinically, choledocholithiasis presents with right upper quadrant or epigastric pain, jaundice, and nausea or vomiting, along with associated symptoms such as dark urine, pale stools, pruritus, fever, chills, and, in cases of pancreatic involvement, epigastric pain radiating to the back. Diagnosis is established through laboratory findings, including elevated total and direct bilirubin, alkaline phosphatase (ALP), gamma-glutamyl transferase (GGT), transiently elevated AST and ALT, increased amylase and lipase in cases of pancreatitis, and leucocytosis in the presence of infection. Imaging modalities play a crucial role, with transabdominal ultrasound serving as the initial diagnostic tool, detecting bile duct dilation but often missing CBD stones. Magnetic resonance cholangiopancreatography (MRCP) is highly sensitive and non-invasive, making it the preferred imaging technique for definitive diagnosis, while endoscopic ultrasound (EUS) offers superior accuracy in cases where MRCP results are inconclusive. Endoscopic retrograde

cholangiopancreatography (ERCP) is both diagnostic and therapeutic, enabling the identification and removal of CBD stones, though it carries risks such as post-ERCP pancreatitis, bleeding, and perforation. Management includes supportive care with fasting (nil per os), intravenous fluid resuscitation, pain management, and antibiotic therapy when cholangitis is present. Definitive treatment primarily involves ERCP with sphincterotomy for stone extraction, followed by elective cholecystectomy in patients with gallbladder stones to prevent recurrence. Alternative approaches, such as percutaneous transhepatic cholangiography (PTC), are utilized in patients who are not candidates for ERCP, while surgical CBD exploration is reserved for cases where ERCP is unsuccessful, or stones are too large to be removed endoscopically. If left untreated, choledocholithiasis can lead to severe complications, including acute cholangitis—characterized by Charcot's triad (intermittent fever, intermittent right upper quadrant pain, and intermittent jaundice) or Reynold's pentad (with the addition of hypotension and mental confusion)—as well as acute pancreatitis, secondary biliary cirrhosis, biliary strictures, sepsis, and multi-organ failure. Timely diagnosis and appropriate intervention are essential to prevent morbidity and mortality associated with this condition.

In developing a model to detect CBD stones early, the initial step involves gathering essential patient information. This includes details like age, gender, and any relevant medical history related to gallbladder or bile duct issues. Symptoms experienced by patients, such as pain in the upper right side of the abdomen or jaundice, should be carefully noted. Lab results from blood tests, including levels of liver enzymes (AST, ALT), alkaline phosphatase (ALP), and total bilirubin, are also crucial data points to collect. Once the data is collected, the next step is to identify predictive features that can help in detecting CBD stones. This involves analyzing the data to pinpoint which symptoms and lab results are most closely linked to the presence of CBD stones.[4] Existing guidelines may provide valuable criteria for predicting CBD stones based on clinical and lab data, which should be considered during this process. With the predictive features identified, the model-building process can commence. Choosing a simple method, such as a decision tree or logistic regression, is advisable for creating the model. The model is then trained using a dataset that includes information on patients with and without CBD stones. To ensure its reliability, the model should be tested using techniques like cross-validation to assess its accuracy and performance. Following model development, evaluation is crucial to determining its effectiveness. Performance metrics

such as sensitivity, specificity, and accuracy are used to measure how well the model performs. Its practicality in aiding doctors' decision-making processes regarding further imaging or intervention should be assessed. [5] Once the model is deemed effective, it can be integrated into healthcare workflows to assist healthcare providers in detecting CBD stones early. Providing adequate training and resources to healthcare workers is essential to ensure the model's proper understanding and utilization. Continuous improvement is the key to maintaining the model's effectiveness over time. Gathering feedback and incorporating new data and insights into the model helps refine its accuracy and relevance. Long-term monitoring of the model's impact on patient outcomes and healthcare efficiency ensures its ongoing utility in clinical practice.

Gallstone disease is a common condition affecting a significant portion of the global population, ranging from 10% to 15%[6]. Interestingly, many individuals with gallstones do not experience any symptoms, with the condition remaining asymptomatic. However, some patients do develop symptoms such as biliary colic, jaundice, or fever. Typically, pain arises when a gallstone obstructs the cystic duct. The primary treatment for both symptomatic and asymptomatic gallbladder diseases is gallbladder removal, known as cholecystectomy. However, in cases where patients are at a heightened risk for surgery under general anesthesia, alternative approaches may be considered. Among the various methods of cholecystectomy, laparoscopic surgery [7] has gained widespread acceptance as the preferred approach. Laparoscopic cholecystectomy has significantly transformed minimally invasive surgery since its introduction just three decades ago. This procedure offers several advantages, including reduced morbidity, shorter hospital stays, improved cosmetic outcomes, and faster recovery times. In the realm of gallbladder surgeries, laparoscopic cholecystectomy is often preferred due to its minimally invasive nature.

Gallstones are often found by chance during medical tests like ultrasounds, CT scans, or HIDA scans. Blood tests, like liver function tests, can also help spot gallbladder issues. Surprisingly, only a small percentage of people with gallstones experience symptoms each year. Doctors have tried different ways to treat gallstones with medicine, but many of these methods haven't worked well. Some treatments involve putting a special liquid into the gallbladder, while others use shock waves to break up the stones. However, these treatments often don't prevent the stones from coming back. When it comes to treating gallbladder problems, the most common approach is to remove the gallbladder altogether through surgery. This is true whether the gallstones cause symptoms or not, unless a

person can't have surgery because of health reasons. Among the different types of surgeries, laparoscopic surgery is the most popular. It's a type of surgery where small cuts are made, and a tiny camera helps the surgeon see inside and remove the gallbladder. The first gallbladder surgery[8] happened way back in 1882, but it wasn't until 1985 that doctors started doing it using a laparoscope. Since then, surgery techniques have gotten better. As doctors get more practice with these surgeries, they're willing to take on more challenging cases. But sometimes, during laparoscopic surgery, things don't go as planned, and doctors have to switch to open surgery. This happens in about 3% to 10% of laparoscopic surgeries worldwide. Several factors can lead to the need to switch from laparoscopic to open cholecystectomy. [9] These include acute cholecystitis, which is inflammation of the gallbladder, as well as anatomical anomalies, extensive scarring (fibrosis), older age, being male, having had previous surgeries in the upper abdomen, and pancreatitis. Other factors include the absence of suitable laparoscopic instruments, a gallbladder wall thickness greater than 3mm, the presence of fluid around the gallbladder (pericholecystic fluid), and intraoperative complications like uncontrolled bleeding or injury to internal organs. converting from laparoscopic to open cholecystectomy has its own set of complications, such as an increased risk of infections at the surgical site and in the respiratory system, as well as a longer stay in the hospital. To address these challenges, researchers have conducted studies to predict difficult laparoscopic cholecystectomy and the likelihood of conversion to open surgery before the operation. Accurately identifying a patient's risk of conversion to open cholecystectomy based on preoperative details can improve patient preparation, streamline the efficiency and timing of operating room procedures, anticipate potential difficulties beforehand, provide clear instructions to surgical assistants, and enhance patient safety by reducing the time required for conversion. Previous studies have attempted to predict conversion using various scoring systems, but these systems have not been widely adopted in surgical practice for several reasons. [10]

RATIONALE OF THE STUDY

The rationale for conducting a study on the predictors of choledocholithiasis in patients presenting with cholecystitis stems from the clinical significance of accurately identifying bile duct stones in this patient population. Choledocholithiasis, or the presence of stones in the common bile duct, is a serious complication of cholecystitis that can lead to potentially life-threatening conditions such as cholangitis, pancreatitis, or obstructive jaundice if left untreated. Currently, the diagnosis of choledocholithiasis often relies on imaging modalities such as endoscopic ultrasound (EUS), magnetic resonance cholangiopancreatography (MRCP), intraoperative cholangiogram (IOC), or endoscopic retrograde cholangiopancreatography (ERCP). However, these tests can be invasive, costly, and associated with adverse events, making it imperative to identify non-invasive predictors that can guide the decision for further diagnostic evaluation. By investigating potential predictors of choledocholithiasis in patients with cholecystitis, we aim to develop a clinical tool that can help clinicians risk-stratify patients and determine the need for additional imaging or endoscopic intervention. This predictive model would enable early detection of bile duct stones, leading to timely management and potentially reducing the risk of complications associated with choledocholithiasis.

AIM AND OBJECTIVES

AIM-The aim of the study is to predict the cases of choledocholithiasis preoperatively in patients presenting with cholecystitis.

OBJECTIVES

- To study clinical findings, biochemical values, and radiological findings in patients with cholecystitis.
- To determine and define the range of laboratory values and develop an algorithm that can be easily applied on presentation.

REVIEW OF LITERATURE

GALL BLADDER: The gallbladder is situated on the visceral surface of the liver, nestled within the fossa for the main liver scissure, where the right and left parts of the liver meet. Shaped like a pear, it has the capacity to hold between 35 to 50 milliliters of bile. Functioning as a bile concentrator and reservoir, the gallbladder plays a crucial role in the digestive process. Its length and shape can vary slightly among individuals. The gallbladder is connected to the liver by connective tissue, forming part of the fibrous capsule that surrounds the liver. This anatomical arrangement ensures proper functioning and coordination between the gallbladder and the liver in the storage and release of the bile for digestion. [11]

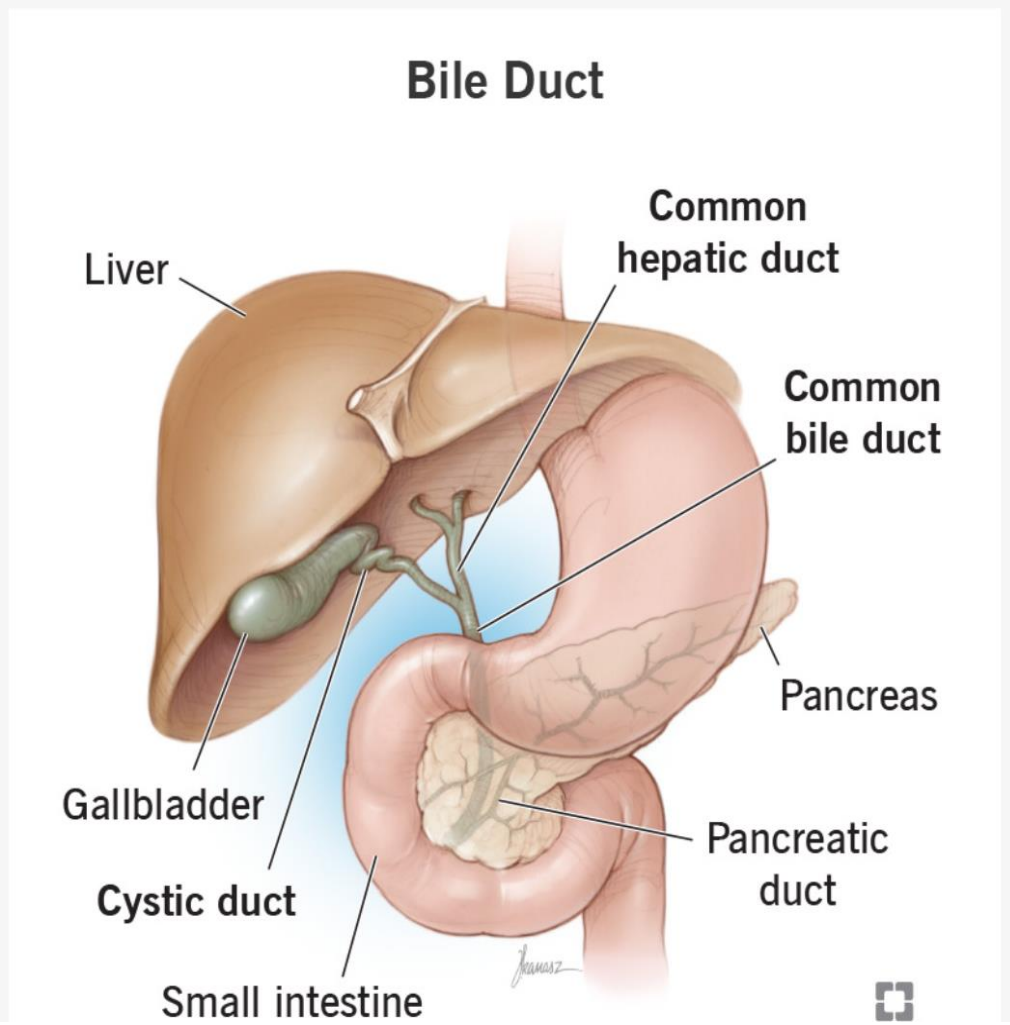


Fig 1- Location of Gall bladder

Location of gall bladder

Gall bladder has normal capacity of about 25ml to 30ml. It is about 7.5 to 12cm long.

Anatomically, Gallbladder is divided into:

- Fundus
- Body
- Infundibulum with Hartmann pouch
- Neck

FUNDUS:

The expanded end of the gall bladder is known as fundus. It usually projects downwards, forwards and to the right, extending beyond the inferior border of the liver to contact the anterior abdominal wall behind the ninth right costal cartilage, where the lateral edge of the right rectus abdominis muscle crosses the costal margin. Posteriorly it is related to the transverse colon, near its commencement. These relations change when the gallbladder is lower, it is in slender females. [11]

BODY:

The largest part of the gall bladder is occasionally in contact with the transverse colon and proximal duodenum. The body is directed up, back and to the left, near the right end of the porta it is continuous with the infundibulum of the gall bladder. It is related above to the liver, below to the transverse colon and further back to the first and upper end of the second segments of the duodenum. [11]

INFUNDIBULUM:

The infundibulum is the part between the body and neck of the gallbladder. Hartmann's pouch is a bulging of the inferior surface of the infundibulum, which is the first part usually to form adhesions to this part of the gut. Broca first described Hartmann's pouch, and it was regarded as a constant feature of gallbladder. But Davies and Harding [1942] have shown its association with pathological conditions, especially dilatations. [12]

NECK:

Here, the gall bladder tapers to become continuous with the cystic duct leading to the biliary tree. The neck contains a mucosal fold, known as Hartmann pouch. This is a common location for gallstones to become lodged causing cholelithiasis. The neck is narrow, curving up and forwards and then abruptly back and downwards ,to become the cystic duct ,at which transition there is a constriction .The neck is attached to the liver by loose connective tissue containing the cystic artery .The mucosa of the neck is obliquely , forming a spiral valve ; when the neck is distended ,this gives its surface a spiral groove. [12]

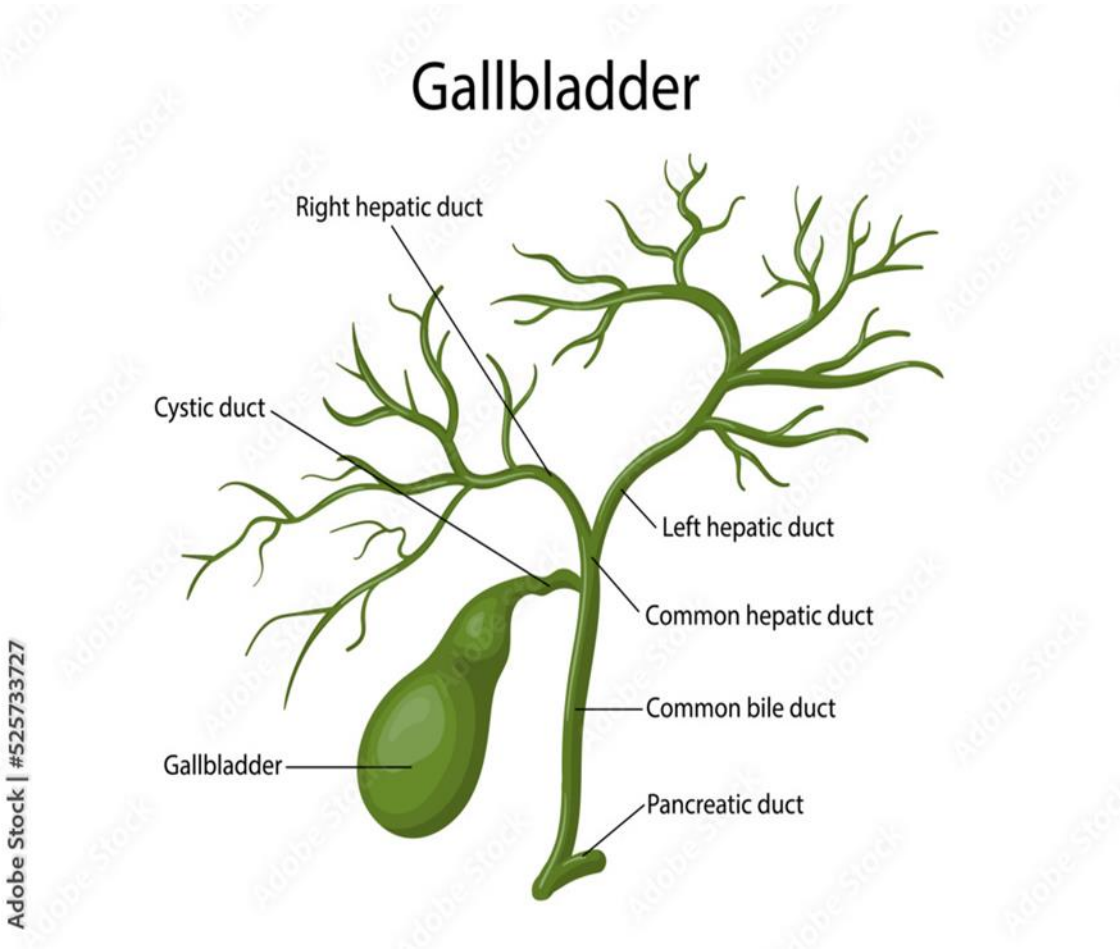


Fig 2: Anatomy of the biliary tree

ANATOMY OF GALLBLADDER: The gallbladder is a small, pear-shaped organ located within the abdominal cavity, specifically in the right hypochondriac region. It serves as a temporary reservoir for bile, a digestive fluid produced by the liver. Bile is concentrated in the gallbladder and is released into the small intestine in response to food intake, particularly fats, to aid in digestion. Anatomically, the gallbladder sits in a fossa on the inferior aspect of the liver, nestled between the right lobe and the quadrate lobe. As a peritoneal structure, it is lined by a serous membrane that forms part of the peritoneum, which also covers most of the abdominal organs. The positioning and structure of the gallbladder make it integral to the digestive system, helping to efficiently process and absorb dietary fats. [11]

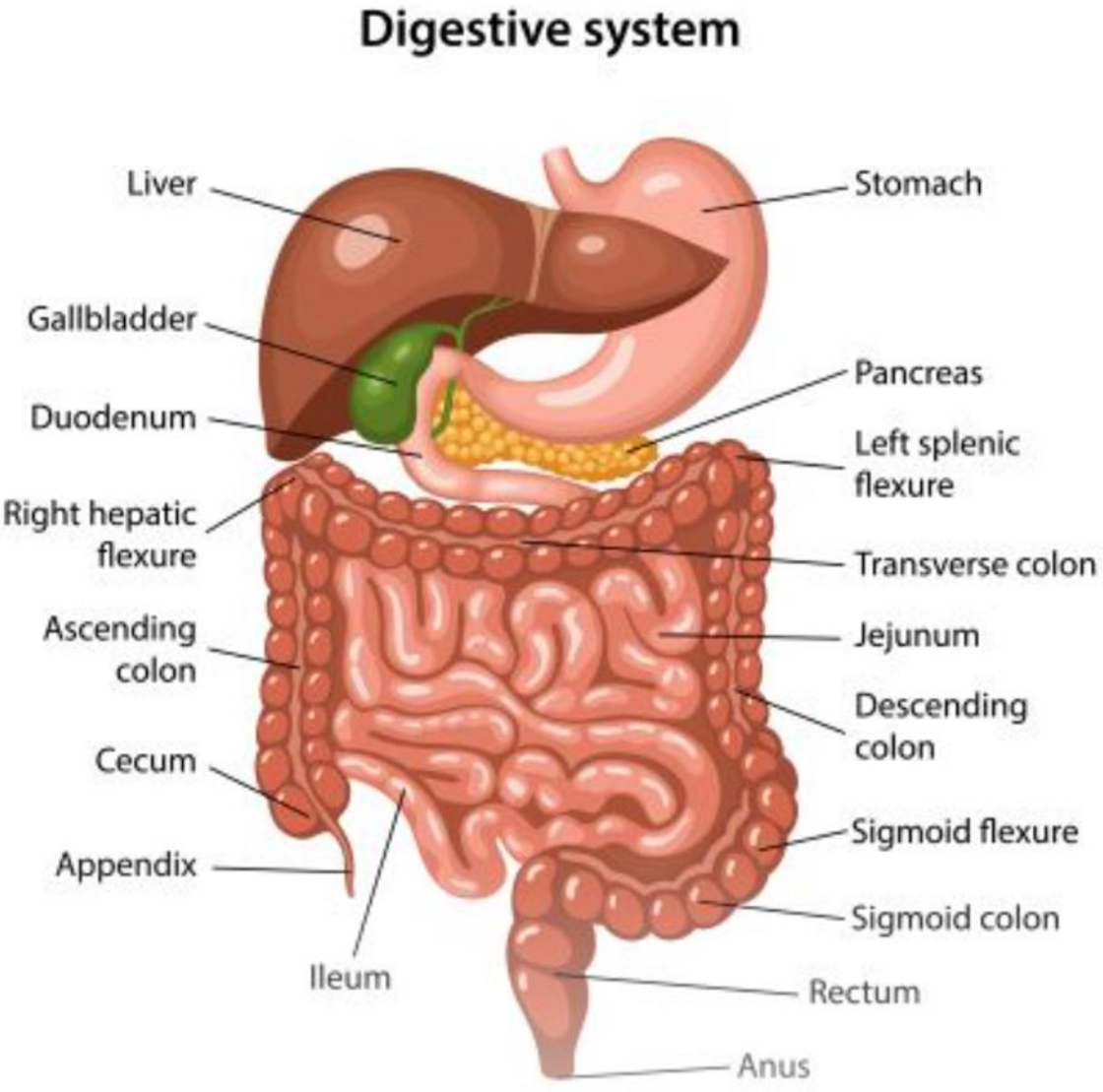


Fig 3: Anatomical relations of GB

ANATOMICAL RELATIONS OF GALLBLADDER:

Anteriorly and superiorly: Inferior border of the liver and the anterior abdominal wall

Posteriorly: Transverse colon and proximal duodenum

Inferiorly: Biliary tree and duodenum

ANATOMICAL STRUCTURE OF GALL BLADDER:

The gall bladder is a diverticulum of the extrahepatic biliary system and is distributed irregularly in the animal kingdom. Gall bladder is only found in the vertebrates and appears first in the cyclostoma. All the carnivores except the whales have gallbladders as have all reptiles and amphibians. Herbivores and birds vary: Giraffes seem to be losing theirs, while seals, otters, walruses, rats, horses and elephants have no gallbladders. The extrahepatic biliary system, otherwise, the extrahepatic biliary apparatus consists of

- Common hepatic duct
- Gall bladder
- Cystic duct
- Common bile duct

CYSTIC DUCT:

The cystic duct is a crucial anatomical structure that connects the gallbladder to the common bile duct. Its proper identification and careful handling during cholecystectomy (the surgical removal of the gallbladder) are essential to avoid surgical complications. The cystic duct typically varies in length, usually measuring between 2 to 4 cm, though about 20% of cystic ducts are less than 2 cm long. This variability can pose challenges during surgery, as shorter ducts provide limited space for placing surgical clips or ligatures, which are used to seal the duct to prevent bile leaks. The cystic duct's diameter is generally 2 to 3 mm but can dilate if there is an underlying pathology. This dilation is significant because the normal bile duct is approximately 5 mm in diameter. Therefore, a dilated cystic duct can sometimes be mistaken for a bile duct, which can lead to surgical errors if not identified correctly. [11] A cystic duct that appears larger than 5 mm should raise concerns about potential misidentification with the bile duct, prompting careful reassessment before it is clipped or ligated during surgery. Anatomically, the cystic duct joins the gallbladder at the neck, where the angle of junction can be quite sharp. The junction may appear as smooth tapering or an abrupt connection. Although rare,

anomalies such as double cystic ducts do occur and can complicate the surgical landscape significantly. The presence of two duct-like structures entering the gallbladder should always be approached with caution and thoroughly investigated to avoid misidentification and ensure surgical safety.

COMMON BILE DUCT: The common bile duct is a vital part of the digestive system, serving as a conduit for bile, a digestive fluid produced by the liver, and stored in the gallbladder. It forms through the convergence of two primary ducts: the common hepatic duct, originating from the liver, and the cystic duct, emerging from the gallbladder. Measuring approximately 7.5 centimeters in length, this duct follows a path that plays a crucial role in the digestive process. the common bile duct courses in an anterolateral direction relative to the portal vein and hepatic artery. As it continues its journey, it descends posteriorly to the first part of the duodenum, the initial segment of the small intestine. Along this route, it travels in close proximity to the gastroduodenal artery, which accompanies it on the left side. This anatomical arrangement ensures efficient transport of bile to the site of digestion. As the common bile duct progresses, it traverses a groove situated on the superolateral aspect of the head of the pancreas. [11] This anatomical relationship highlights the close association between the bile duct and the pancreas, an essential organ involved in both digestion and hormone regulation. Eventually, the common bile duct reaches its destination: the second part of the duodenum, where it enters intraduodenally. Within the confines of the duodenum, the common bile duct encounters a specialized structure known as the sphincter of Oddi. This muscular valve surrounds the duct and regulates the flow of bile and pancreatic juices into the small intestine. Positioned at the summit of the ampulla of Vater, the sphincter of Oddi ensures controlled release of digestive fluids, contributing to the efficient breakdown and absorption of nutrients. Understanding the intricate anatomy and functional significance of the common bile duct underscores its critical role in the digestive process. By facilitating the transport of bile from the liver and gallbladder to the small intestine, this duct ensures optimal digestion and absorption of nutrients, thereby supporting overall digestive health. [12]

HEPATIC DUCT: The hepatic ducts, arising from the right and left lobes of the liver, play a crucial role in the drainage of bile from the liver. These ducts ultimately converge to form the common hepatic duct, a key component of the biliary system. The point of convergence typically occurs above the hilar plate, an anatomical landmark located near

the porta hepatis where the major blood vessels and ducts enter and exit the liver. The common hepatic duct, measuring less than 2.5 centimeters in length, serves as a conduit for bile transport from the liver to the gallbladder or directly to the duodenum. In approximately 80% of cases, the common hepatic duct is joined by the cystic duct, which emerges from the gallbladder. This union typically occurs supra duodenal, meaning above the level of the duodenum, where the bile duct system and the duodenum meet. [12]

This anatomical arrangement facilitates the coordinated flow of bile from the liver and gallbladder into the gastrointestinal tract, where it aids in the digestion and absorption of fats.[13] Gallstones and benign biliary strictures are the two most common biliary tract disorders that require multidisciplinary management involving surgeons, endoscopists, and interventional radiologists.[14] Understanding the structure and anatomical relationships of the hepatic ducts and the common hepatic duct provides insight into the complex mechanisms underlying bile transport and digestive function within the body. [15]

CALOT'S TRIANGLE: Described by Jean Francois Calot, the hepatobiliary triangle, also known as Calot's triangle, is a triangular area crucial in cholecystectomy procedures. This triangular space is defined inferiorly by the cystic duct, superiorly by the inferior surface of the liver, and medially by the common hepatic duct. It serves as a significant surgical landmark due to it containing the branching of the cystic artery from the right hepatic artery, which is vulnerable during surgery. Many aberrant forms of the right hepatic ducts and arteries are often encountered within this triangle, with one of the most problematic anomalies being the tortuous course of the hepatic artery, known as 'caterpillar turn' or 'Moynihan's hump'. Such variations can pose challenges during cholecystectomy procedures. [16]

The contents of Calot's triangle include:

- Cystic artery

- Right hepatic artery

- Calot lymph node (also known as the lymph node of Lund)

- Lymphatic vessels from the gallbladder

These structures within Calot's triangle are important anatomical landmarks for surgeons performing cholecystectomy, guiding their approach and ensuring careful dissection to avoid injury to critical structures and minimize complications. Understanding the contents and variations within Calot's triangle is essential for safe and successful gallbladder surgeries.[17]

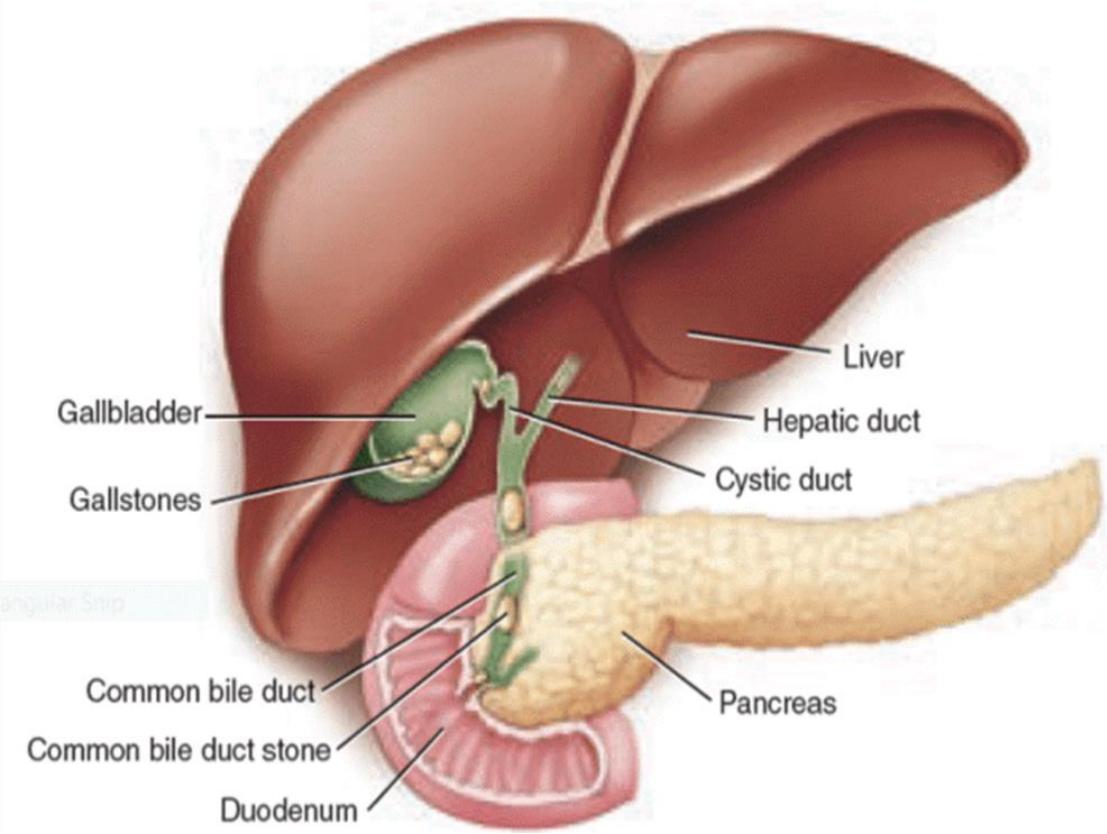


Fig 4: Showing GB stone and CBD stone

ACUTE CALCULOUS CHOLECYSTITIS:

Acute calculous cholecystitis refers to the inflammation of the gallbladder resulting from the obstruction of the cystic duct by a stone. Unlike chronic cholecystitis or biliary colic, where the obstruction is temporary and recurrent, acute cholecystitis involves persistent blockage, leading to inflammation, edema, and subserosal hemorrhage. The stagnant bile in the gallbladder becomes infected, further worsening inflammation and potentially causing ischemia and necrosis. In severe cases, acute cholecystitis can progress to acute gangrenous cholecystitis, often complicated by infection with gas-forming organisms, leading to acute emphysematous cholecystitis.

Presentation:

Patients with acute cholecystitis typically present with fever and pain localized to the right upper quadrant. Physical examination often reveals tenderness and guarding upon palpation in the affected area. The obstruction of the cystic duct, usually by a gallstone lodged in the gallbladder neck, triggers visceral pain fibers, resulting in continuous discomfort in the epigastrium or right upper quadrant. Unlike the intermittent nature of biliary colic, this pain tends to be persistent. Additionally, a positive Murphy sign, characterized by the cessation of respiration upon palpation under the right costal margin, suggests inflammation of the gallbladder and adjacent peritoneal surfaces. Grading systems such as the Tokyo Guidelines and AAST Emergency General Surgery guidelines assist in categorizing the severity of cholecystitis, aiding in treatment planning. [18]

Diagnosis:

Transabdominal ultrasonography serves as a sensitive and cost-effective diagnostic modality for acute cholecystitis, with high sensitivity and specificity rates. In addition to detecting gallstones, ultrasound can identify pericholecystic fluid, gallbladder wall thickening, and a sonographic Murphy sign. While a comprehensive clinical assessment, including history, physical examination, and laboratory tests, is often sufficient for diagnosis, a HIDA scan may be necessary in atypical cases to confirm cystic duct obstruction. Computed tomography (CT) imaging may also reveal characteristic findings of acute cholecystitis, albeit with lower sensitivity compared to ultrasound.

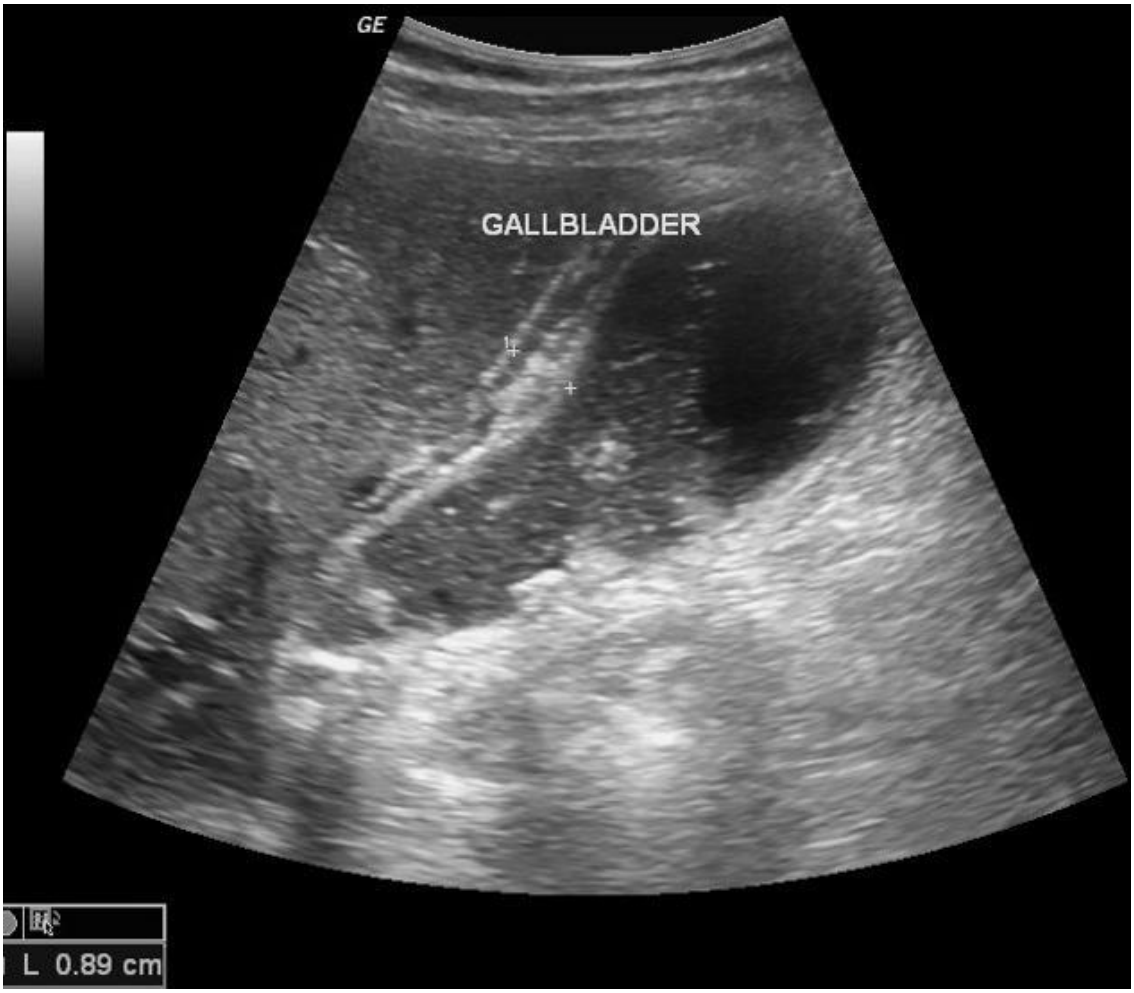


Fig 5: USG showing acute calculous cholecystitis

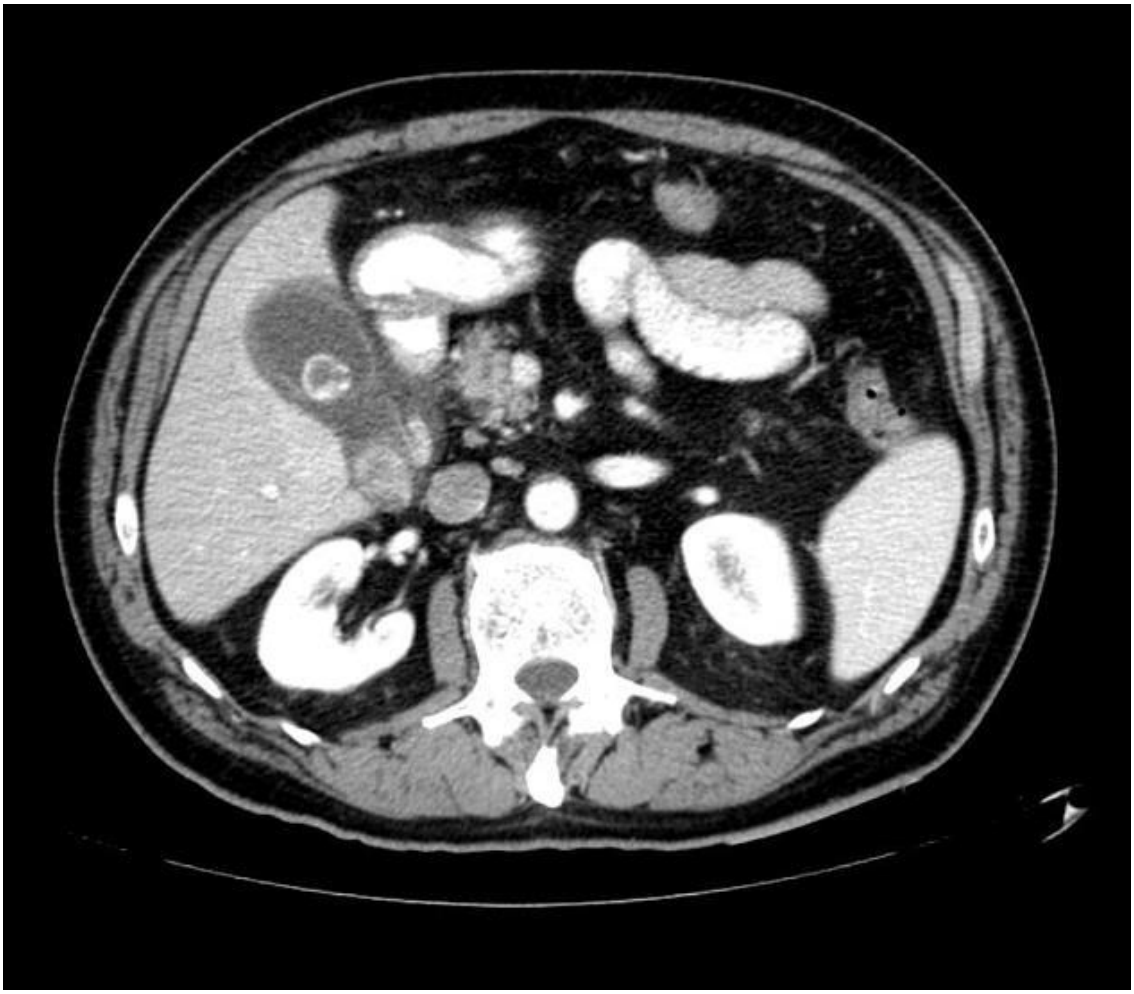


Fig 6: CT Whole Abdomen showing acute calculous cholecystitis, pericholecystic edema and thickened gb wall.

Treatment:

The management of acute cholecystitis is tailored to disease severity and patient status. Initial management typically includes fasting, intravenous fluids, and parenteral antibiotics to address secondary infection. Given the prevalence of gram-negative aerobes in acute cholecystitis, broad-spectrum antibiotics are recommended. Pain control with parenteral narcotics is often necessary. Cholecystectomy, whether performed via open or laparoscopic techniques, remains the definitive treatment. Recent evidence supports early laparoscopic cholecystectomy within the first week of symptom onset, demonstrating comparable outcomes to delayed surgery. In cases where immediate surgical intervention is not feasible, percutaneous cholecystostomy tube placement may be considered as a bridging measure to drain infected bile, with subsequent elective cholecystectomy planned. The Tokyo Guidelines offer valuable insights into predicting disease severity and guiding management decisions in acute cholecystitis. [19]

CHRONIC CHOLECYSTITIS: Recurrent episodes of biliary colic, characterized by temporary blockage of the cystic duct, can lead to inflammation and scarring in the neck of the gallbladder and cystic duct. This process, known as chronic cholecystitis, results from repeated bouts of inflammation and fibrosis. The diagnosis of chronic cholecystitis is closely linked to biliary colic since it arises from these recurrent attacks. Therefore, the presentation typically mirrors that of symptomatic cholelithiasis or biliary colic. The hallmark symptom of biliary colic is pain that occurs after consuming a fatty meal, triggering increased secretion of cholecystokinin (CCK) in response to fat in the duodenum. While only half of patients may explicitly associate their pain with food, the classic pain pattern involves discomfort in the epigastrium or right upper quadrant, often radiating to the shoulder blade. Despite the term "colic," the pain tends to be constant rather than intermittent. These episodes of pain usually last a few hours, distinguishing them from more prolonged pain associated with acute cholecystitis, which may also be accompanied by fever. biliary colic pain can manifest with other gastrointestinal symptoms such as bloating, nausea, or vomiting. It's important to note that symptomatic gallstones pose a higher risk of complications compared to asymptomatic ones, warranting consideration for surgical intervention.

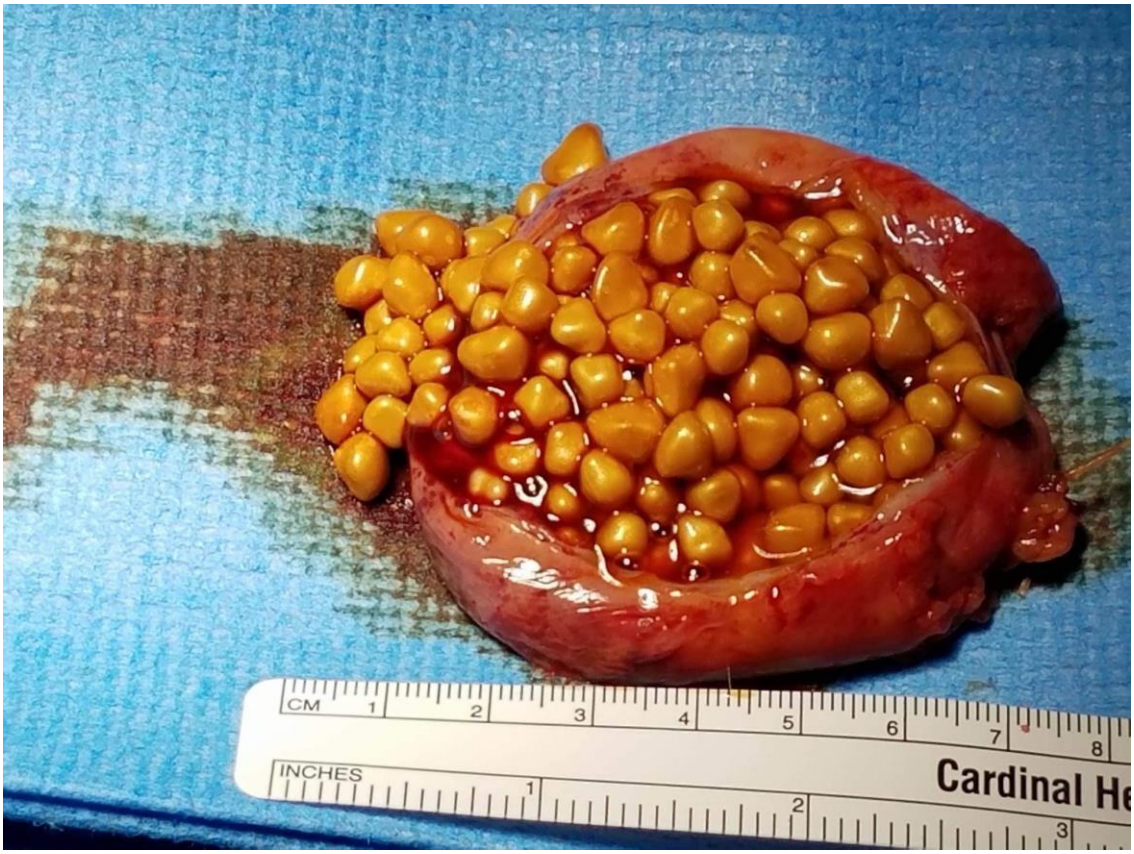


Fig 7: Gall bladder showing multiple calculi

Symptomatic cholelithiasis serves as an indication for cholecystectomy, particularly when stones are confirmed and symptoms persist. the presence of recurrent biliary colic episodes, along with documented gallstones and associated symptoms, guides the decision to proceed with cholecystectomy, aiming to alleviate symptoms and mitigate the risk of complications associated with symptomatic cholelithiasis. [20]

Diagnosis:

Identifying chronic cholecystitis hinges on a thorough evaluation of a patient's medical history, particularly symptoms suggestive of biliary tract problems. Utilizing transabdominal ultrasonography plays a pivotal role in confirming the presence of gallstones, a hallmark feature known as cholelithiasis. Beyond gallstone detection, ultrasound imaging can unveil additional valuable information such as common bile duct (CBD) dilation, gallbladder polyps, porcelain gallbladder, or indications of hepatic parenchymal processes. Moreover, ultrasound findings may also reveal cholesterolosis, characterized by the buildup of cholesterol within gallbladder mucosal macrophages. Interestingly, even in cases where gallstones are not visually apparent, the presence of sludge within the gallbladder on ultrasound, coupled with corresponding symptoms, can suggest the occurrence of biliary colic.

Treatment:

Effective management of chronic cholecystitis involves tailoring treatment strategies based on the severity of symptoms and associated risks. For patients experiencing significant symptoms attributable to gallstones, elective cholecystectomy, a surgical procedure to remove the gallbladder, is typically recommended. While cholecystectomy is generally considered safe, it's essential to weigh the potential risks and benefits before proceeding with surgery. In cases where symptoms are mild and the risk of complications from gallstones is low (ranging from 1% to 3% per year), a conservative approach involving observation, along with dietary and lifestyle modifications, may suffice. However, for individuals with more severe or recurrent symptoms, indicative of a higher complication rate (approximately 7% per year), elective laparoscopic cholecystectomy is advised. Importantly, cholecystectomy has been shown to be curative in the majority of cases, effectively alleviating symptoms and restoring patients' overall well-being. [21]

TREATMENT MODALITIES IN GALL BLADDER DISEASE

LAPAROSCOPIC CHOLECYSTECTOMY- Laparoscopic cholecystectomy has largely become the preferred technique for addressing gallstones and inflammation of the gallbladder, replacing the older, more invasive open cholecystectomy for most patients, unless there are specific reasons not to use this method. The key advantage of the laparoscopic approach is its minimal invasiveness, which generally leads to fewer infections, quicker recovery times, and less post-surgical pain for patients compared to the open method. During a laparoscopic cholecystectomy, small incisions are made in the patient's abdomen. These incisions are used to insert narrow tubes called ports, through which surgical instruments and a small camera are introduced into the abdominal cavity. This camera is crucial as it projects a magnified image of the internal organs onto a monitor, allowing the surgeon to see the operating area clearly. By watching this monitor, the surgeon can manipulate the instruments precisely, performing the surgery without the need for a large incision. The surgery begins with the patient under anesthesia. An initial incision is made at the belly button, and a device known as a Veress needle or the Hasson technique is used to enter the abdominal cavity. The cavity is then inflated with carbon dioxide gas, which creates enough space for the surgeon to work. The camera is inserted through the belly button to provide a clear view, and additional ports might be placed under the ribs to facilitate the use of surgical tools. The surgeon identifies and secures the gallbladder, carefully manipulating it to expose and access the critical area known as Calot’s triangle. This area is where the cystic duct and cystic artery are located. These structures are then clipped to prevent bleeding and bile leakage and cut to detach the gallbladder. Finally, the gallbladder is removed through one of the ports. [22]

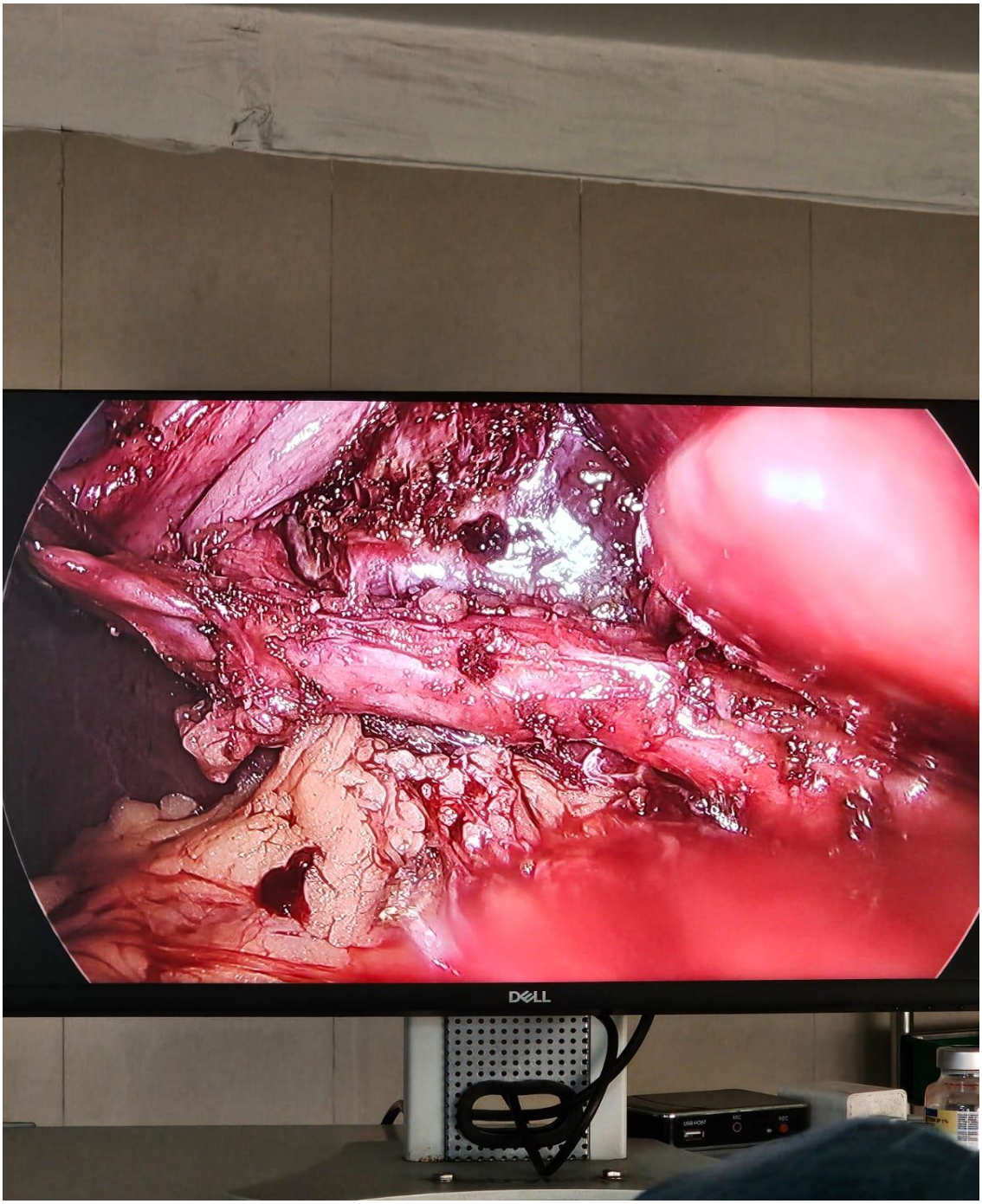


Fig 8: Laparoscopic cholecystectomy

LAPAROSCOPIC CHOLECYSTECTOMY

In recent years, a more advanced technique known as Laparoendoscopic Single-Site Surgery (LESS) or Single Incision Laparoscopic Surgery (SILS) has been developed[23]. This technique further reduces the invasiveness of the procedure by using only one incision in the navel, through which all surgical instruments are inserted. This not only minimizes the number of incisions but also effectively conceals any surgical scarring within the navel, leaving virtually no visible marks post-surgery. This approach can be particularly appealing for patients concerned about aesthetics, as it offers an almost scar-free result while potentially reducing recovery time.

OPEN CHOLECYSTECTOMY[24]: Open cholecystectomy is a surgical method used to remove the gallbladder, typically reserved for specific situations where laparoscopic cholecystectomy is not feasible or has failed. Such situations might include cases where a patient's severe systemic illness makes the standard laparoscopic approach unsuitable, particularly if the patient cannot tolerate pneumoperitoneum—the insufflation of carbon dioxide gas into the abdomen required for laparoscopic procedures. Open cholecystectomy is also used during certain complex surgeries such as part of a liver transplant. [25]

CHOLEDOCHOLITHIASIS:

Choledocholithiasis, the condition marked by the presence of stones within the common bile duct (CBD), is often asymptomatic but can be detected in a significant portion of patients undergoing biliary imaging. These stones can either form within the duct itself, termed primary stones, or migrate from the gallbladder, known as secondary stones. Primary stones, typically characterized by their brown pigment composition, are commonly associated with bacterial infections, particularly prevalent in certain populations such as Asian communities. Conversely, secondary stones are more frequently observed in regions like the United States. Clinical manifestations of common duct stones can range from episodes of biliary colic to more severe presentations such as obstructive jaundice. Jaundice often presents with pain due to the sudden obstruction, leading to rapid distention of the bile duct and subsequent activation of pain receptors. In severe cases, choledocholithiasis can progress to cholangitis, characterized by Charcot's triad[26] of symptoms including intermittent right upper quadrant pain,

intermittent fever, and intermittent jaundice, which can escalate to Reynolds pentad[27] in critical situations.

DIAGNOSIS:

Diagnosis of asymptomatic choledocholithiasis often occurs incidentally but may prompt further investigation when symptoms such as biliary pain, jaundice, or abnormal liver function tests are present. Magnetic resonance cholangiopancreatography (MRCP) and endoscopic retrograde cholangiopancreatography (ERCP) are commonly employed diagnostic techniques, with ERCP also serving a therapeutic role by facilitating stone clearance. In select cases, preoperative ERCP may be indicated, particularly in patients with complicating factors like cholangitis, biliary pancreatitis, or significant comorbidities, despite the associated risk of surgical site infection. [28]

ULTRASOUND[29]- Transabdominal ultrasound emerges as a versatile and invaluable diagnostic modality, offering a comprehensive evaluation of biliary pathologies with its notable sensitivity, cost-effectiveness, reliability, and reproducibility. It serves as a cornerstone in the initial assessment of jaundice or symptoms indicative of biliary diseases, distinguishing between medical jaundice, stemming from hemoglobin breakdown and subsequent conjugation, and surgical jaundice, arising from obstructive excretion. One of the hallmark findings on ultrasound in the setting of jaundice is the detection of a dilated common bile duct (CBD), a telltale sign of potential obstruction. This obstruction may be attributed to calculi, often associated with pain, or tumors, typically presenting without pain. The gallbladder, due to its superficial location and absence of overlying bowel gas interference, is readily evaluated via ultrasound, making it an ideal imaging modality for diagnosing gallbladder diseases. Ultrasound's remarkable specificity and sensitivity in detecting cholelithiasis, commonly known as gallstones, stem from the distinct reverberation pattern exhibited by these calcified entities, often accompanied by characteristic shadowing. The dynamic nature of gallstones, exhibiting positional mobility within the patient, aids in distinguishing them from fixed gallbladder polyps and slower-moving sludge formations, characterized by a less defined echogenic pattern. ultrasound serves as a discerning tool for identifying pathologic changes indicative of various gallbladder afflictions. For instance, the hallmark signs of cholecystitis, such as gallbladder wall thickening and pericholecystic fluid accumulation, are readily discernible via ultrasound imaging. In addition to its

discriminative prowess in categorizing jaundice etiology into medical versus surgical, ultrasound occasionally unveils the underlying cause of obstructive jaundice, unmasking CBD stones or even sinister entities like cholangiocarcinoma. This multifaceted diagnostic capability positions transabdominal ultrasound as an indispensable tool in the armamentarium of clinicians grappling with biliary disorders, offering not only diagnostic clarity but also therapeutic guidance and prognostic insight.

Magnetic Resonance Imaging (MRI) and its variant, Magnetic Resonance Cholangiopancreatography (MRCP)[30], are pivotal in the realm of diagnostic imaging, offering a noninvasive means to scrutinize the intricate details of the biliary tree and pancreas. Unlike traditional methods reliant on ionizing radiation, such as CT scans, MRI capitalizes on the inherent properties of water within bile to render highly detailed anatomical images. This methodological approach not only ensures superior delineation of both intrahepatic and extrahepatic biliary structures but also provides a comprehensive view of the pancreas. The utility of MRI and MRCP extends beyond mere diagnostic imaging; it plays a crucial role in treatment planning for a spectrum of biliary and pancreatic pathologies. Whether strategizing surgical interventions for neoplasms or navigating complex biliary disorders, MRI offers a radiation-free, noninvasive solution that obviates the need for invasive procedures or exposure to harmful radiation. Moreover, the ability to generate cholangiopancreatograms, leveraging the water content of bile, further enhances its diagnostic prowess, making it an indispensable tool in the armamentarium of modern medicine.

Computed Tomography Endoscopic Retrograde Cholangiopancreatography (CT-ERCP) emerges as another formidable contender in the diagnostic landscape. By amalgamating the precision of computed tomography with the diagnostic capabilities of endoscopic retrograde cholangiopancreatography, this modality surmounts the limitations of conventional ultrasound techniques. CT-ERCP excels in providing intricate anatomical details crucial for delineating the site and etiology of biliary obstructions. Furthermore, its utility extends beyond diagnostic realms to encompass preoperative planning, particularly with the advent of triple-phase imaging techniques, which have supplanted traditional angiographic approaches. [31]

Endoscopic Retrograde Cholangiopancreatography (ERCP), despite its invasive nature and associated risks, remains a cornerstone in the diagnosis and management of

biliary diseases. Through a combination of endoscopic visualization and fluoroscopic guidance, ERCP facilitates the injection of contrast material to meticulously delineate the biliary tree. This technique not only aids in diagnosing a myriad of biliary pathologies but also offers therapeutic interventions, such as tissue sampling and obstruction relief. Consequently, ERCP proves indispensable in both benign and malignant conditions, providing a versatile tool for clinicians grappling with complex biliary dilemmas. the landscape of diagnostic imaging is replete with modalities catering to the diverse needs of patients with biliary and pancreatic disorders. Whether leveraging the noninvasive precision of MRI and MRCP, the anatomical clarity of CT-ERCP, or the diagnostic and therapeutic capabilities of ERCP, clinicians are equipped with an array of tools to navigate the complexities of biliary pathology with precision and efficacy.

TREATMENT

Treatment strategies for choledocholithiasis typically involve interventions such as ERCP or CBD exploration, which can be performed through laparoscopic or open techniques. Endoscopic sphincterotomy combined with stone extraction is an effective approach, although challenges may arise in cases of larger stones or anatomical variations. In such instances, alternative procedures like percutaneous transhepatic cholangiography (PTC) may be considered. Postoperative ERCP is recommended for the extraction of stones identified but not removed during cholecystectomy. It's important to note that long-term recurrence rates remain high in patients managed solely by ERCP without concurrent cholecystectomy, necessitating a comprehensive treatment approach.

Endoscopic Retrograde Cholangiopancreatography (ERCP)[32] is a widely utilized diagnostic and therapeutic procedure for choledocholithiasis, which involves the presence of gallstones in the common bile duct (CBD). The procedure begins with pre-procedure preparation, requiring the patient to remain nil per os (NPO) for 6–8 hours to reduce the risk of aspiration. Intravenous (IV) hydration and electrolyte correction are administered, along with prophylactic antibiotics in cases of suspected cholangitis or biliary infection. Sedation, either conscious or general anaesthesia, is provided to ensure patient comfort. During the procedure, a duodenoscope is inserted through the oral cavity, traversing the oesophagus and stomach to reach the duodenum, where the ampulla of Vater is located. This allows for the cannulation of the common bile duct, where a thin

catheter is advanced into the CBD. A contrast dye is injected, and fluoroscopic imaging is utilized to identify the presence and location of stones.

The removal of CBD stones can be accomplished through various techniques. Endoscopic sphincterotomy (ES) involves making a small incision in the sphincter of Oddi to facilitate stone passage into the intestine. Balloon sphincteroplasty, an alternative to sphincterotomy, uses a balloon to dilate the sphincter. Stone extraction can be performed using a balloon catheter or wire basket, depending on the stone's size and location. In cases where stones are too large for direct extraction, mechanical lithotripsy is employed to fragment the stones into smaller pieces for easier removal. If complete stone clearance is not feasible, biliary stents may be placed to maintain bile flow and prevent obstruction. Following the procedure, post-procedure monitoring includes observation for potential complications such as post-ERCP pancreatitis, bleeding, or perforation. The patient is gradually reintroduced to a diet, beginning with clear liquids, and repeat ERCP may be necessary if residual stones persist.

In cases where ERCP is unsuccessful or unavailable, **Common Bile Duct Exploration (CBDE)** is performed through surgical or alternative endoscopic approaches. The procedure is indicated for patients with choledocholithiasis when ERCP fails, when large or multiple stones are present, or when the bile duct is significantly dilated. Additional indications include biliary strictures (benign or malignant), biliary trauma, stent removal or placement, and suspected parasitic infections such as Ascaris lumbricoides or Clonorchis sinensis. The exploration of the CBD can be achieved through **laparoscopic, open, or percutaneous techniques**.

Laparoscopic Common Bile Duct Exploration (LCBDE) is a minimally invasive approach, typically performed during laparoscopic cholecystectomy. It involves small incisions and the use of a laparoscope to access the bile duct. This method is preferred when ERCP is unsuccessful or unavailable. **Open Common Bile Duct Exploration (OCBDE)**, on the other hand, is a traditional open surgical approach reserved for complex cases involving large or impacted stones, bile duct injury, or strictures. It requires a larger incision and a longer recovery period but allows for better visualization and manual extraction of stones. **Percutaneous Transhepatic Cholangiography (PTC)** is another alternative for patients who cannot undergo ERCP, wherein a needle is inserted

percutaneously through the liver to access the bile ducts, facilitating drainage or stent placement.

For **LCBDE**, preoperative preparation includes fasting, IV fluid administration, antibiotic prophylaxis, and imaging confirmation via Magnetic Resonance Cholangiopancreatography (MRCP) or ultrasound. The procedure involves the placement of trocars for laparoscopic access, intraoperative cholangiography to visualize the CBD, and choledochotomy (a small incision in the bile duct) to extract stones using a balloon catheter or wire basket. The duct is then flushed to clear any residual stones. Closure methods include primary closure, which is preferred in most cases, or T-tube placement, which facilitates bile drainage and healing. Postoperative care includes monitoring for bile leaks, infection, or retained stones, gradual dietary progression, and follow-up cholangiography to confirm bile duct clearance.

For patients requiring OCBDE[33], a right upper quadrant incision (Kocher's incision) is made to expose the bile duct. The CBD is incised (choledochotomy), and stones are extracted using forceps or irrigation. Depending on the patient's condition, primary closure or T-tube placement is performed to aid in bile drainage. In cases involving strictures or biliary injury, biliary reconstruction may be necessary. Postoperatively, patients require close monitoring for bile leaks, infection, and residual stones, with the T-tube typically left in place for 2–3 weeks before removal. Cholangiography is performed before T-tube removal to ensure adequate bile flow, and patients are gradually transitioned back to normal activity.

In summary, ERCP remains the gold standard for diagnosing and managing choledocholithiasis, with a variety of techniques available for stone removal and biliary decompression. However, when ERCP is not feasible or fails, alternative approaches such as laparoscopic, open, or percutaneous common bile duct exploration provide effective options for stone extraction and bile duct management. Proper patient selection and timely intervention are critical in preventing complications such as bile duct obstruction, recurrent cholangitis, and biliary strictures, ensuring optimal outcomes for patients with choledocholithiasis.

During an open cholecystectomy, a surgical incision about 10 to 15 cm long is made just below the edge of the right rib cage. The liver is carefully retracted upwards to allow surgeons clear access to the gallbladder. The surgery typically involves a top-down

approach where the gallbladder is separated from the liver using tools like electrocautery, which uses electrically generated heat to cut through tissue and seal blood vessels because it involves a larger incision, open cholecystectomy is associated with more significant postoperative pain and a higher risk of complications such as wound infections and incisional hernias compared to the laparoscopic method.

Woo et al. (2024)[34] This study aimed to assess the applicability of the 2019 ASGE clinical predictors for choledocholithiasis in the Korean population and to develop a more accurate, locally adapted predictive model. Conducted as a single-center retrospective study at Konyang University Hospital, the research analyzed data from 1,223 patients who underwent laparoscopic cholecystectomy between 2009 and 2021. Using multivariate logistic regression, the study evaluated predictors such as age, liver enzymes (ALP, AST, ALT, GGT), total bilirubin, and common bile duct (CBD) dilatation, with imaging support from MRCP or EUS. The Korean-specific cutoff values identified were age >70 years, ALP >77.5 U/L, AST >28.5 U/L, ALT >26.5 U/L, GGT >82.5 U/L, total bilirubin >0.95 mg/dL, and presence of CBD dilatation. Among these, age >70 years, ALP >77.5 U/L, GGT >82.5 U/L, and CBD dilatation were found to be significant independent predictors. A scoring model was developed based on these variables, classifying patients into low-risk (<1.0 point), intermediate-risk (1.0–5.5 points), and high-risk (>5.5 points) groups. The model demonstrated good predictive performance with an AUC of 0.777, outperforming the ASGE guideline's AUC of 0.763. The study concluded that while the ASGE guidelines are useful, Korean-specific cutoff values and models enhance diagnostic accuracy, potentially reducing unnecessary ERCP procedures and improving preoperative management.

Yuen et al. (2023)[35] The scoping review titled "Liver Function Tests as Predictors of Choledocholithiasis", published in the AME Surgical Journal (2023), evaluated the effectiveness of liver function tests (LFTs) as non-invasive predictors of choledocholithiasis. The review included 25 studies involving a total of 19,919 patients, analysing data across five main themes: bilirubin levels, other LFTs (GGT, ALP, AST, ALT), application of the 2019 ASGE guidelines, trends in repeat LFTs, and inflammatory markers. The findings revealed considerable variability in the diagnostic value of LFTs. While some studies identified bilirubin (with cut-offs ranging from 1.2 to >4 mg/dL) as

a statistically significant predictor, others did not, and overall, it showed high specificity but low sensitivity. Among other LFTs, GGT and ALP were frequently reported as reliable predictors, with GGT noted for its sensitivity and ALP for its specificity. AST and ALT were also significant in some studies, particularly among younger patients and those with prior cholecystectomy. The ASGE guideline criteria were found to be suboptimal in many cases, leading to unnecessary ERCP in over 40% of patients classified as high-risk. Repeat LFTs showed limited additional diagnostic value, though declining trends may reflect spontaneous stone passage. White cell count was generally not a useful predictor. 2Ultimately, the review concluded that LFTs alone are insufficient for predicting choledocholithiasis and should be used in conjunction with clinical evaluation and imaging findings.

Song et al. (2021) [36], The focus is directed towards the intriguing nexus between COVID-19 infection and hepatobiliary complications, presenting a compelling case where acute cholecystitis transitioned into acute choledocholithiasis in a patient who tested positive for COVID-19. This case study not only underscores the complexities of managing hepatobiliary disorders in the context of COVID-19 but also sheds light on potential mechanisms underlying such transformations, thereby emphasizing the necessity for vigilant monitoring and comprehensive care strategies in affected individuals. The case presented by Song et al. serves as a poignant reminder of the multifaceted nature of COVID-19 and its potential to impact various organ systems beyond the respiratory tract. The observed transition from acute cholecystitis to acute choledocholithiasis in the context of COVID-19 infection raises intriguing questions regarding the underlying pathophysiological mechanisms, including the potential role of systemic inflammation, immune dysregulation, and viral-induced hepatobiliary injury. The study underscores the importance of heightened clinical awareness and vigilance in managing hepatobiliary complications in COVID-19 patients, particularly in those with pre-existing biliary pathologies or risk factors. The timely recognition and appropriate management of such complications are paramount to mitigating adverse outcomes and optimizing patient care. Song et al.'s study underscores the need for interdisciplinary collaboration between gastroenterologists, hepatologists, infectious disease specialists, and critical care teams in navigating the complexities of COVID-19-associated hepatobiliary complications. This collaborative approach enables comprehensive evaluation, timely interventions, and personalized care delivery tailored to the unique

needs of each patient. Song et al.'s study offers valuable insights into the hepatobiliary manifestations of COVID-19 infection, highlighting the potential for acute cholecystitis to evolve into acute choledocholithiasis in affected individuals. By elucidating the clinical course and potential mechanisms underlying this transformation, the study underscores the importance of vigilant monitoring, interdisciplinary collaboration, and evidence-based management strategies in optimizing outcomes for COVID-19 patients with hepatobiliary complications.

Siddhartha Reddy et al. (2020)[37] The study evaluates the limitations of ASGE (American Society of Gastrointestinal Endoscopy) and ESGE (European Society of Gastrointestinal Endoscopy) guidelines in predicting choledocholithiasis in acute calculous cholecystitis (ACC) patients, finding their sensitivity and specificity suboptimal. Through a retrospective analysis of 173 ACC cases, it identifies elevated alkaline phosphatase (ALP) and dilated common bile duct (CBD) on ultrasound as independent positive predictors, while acute biliary pancreatitis is a negative predictor. Given that ACC can alter liver function tests, the study proposes a new predictive model that stratifies patients based on these factors, improving diagnostic accuracy and reducing unnecessary ERCPs. Despite its retrospective design and referral bias, the study highlights the need for revised guidelines and prospective validation of its proposed model.

Gouveia et al. (2018) [38] This study assessed the reliability of the ASGE (American Society of Gastrointestinal Endoscopy) choledocholithiasis risk score in patients with acute cholecystitis. While the ASGE score is widely used to assess the likelihood of choledocholithiasis (common bile duct stones), it was never specifically validated for use in patients with acute cholecystitis. This is important because clinical and biochemical parameters are often altered in cholecystitis, which may lead to misclassification and unnecessary procedures. The study shows that applying this score in such patients results in a high false-positive rate, leading to a significant number of potentially avoidable ERCPs—a procedure with known complications.

Among 4,369 patients, only 40 (0.92%) had suspected choledocholithiasis. Of these, 31 were classified as high-risk and 9 as intermediate risk. The diagnostic performance of the score was limited: the high-risk group had a sensitivity of 88.8% but a low positive

predictive value (PPV) of 51.6%, while the intermediate group had a PPV of just 22.2%. These findings indicate a high rate of false positives and unnecessary ERCPs. The study concludes that the ASGE score is not suitable for this patient population and recommends using more accurate, less invasive diagnostic methods like MRCP or EUS before proceeding to ERCP.

Chisholm et al. (2018)[39] This study evaluates preoperative predictors of choledocholithiasis (CDL) in patients with acute calculous cholecystitis (ACC), addressing the limitations of current guidelines that fail to specifically stratify ACC cases. Through a retrospective analysis of 366 patients, the study identifies ALT >3x ULN, ALP > ULN, and a common bile duct (CBD) diameter >6mm as the most significant predictors of CDL. The proposed multivariable logistic regression model, validated on a separate cohort, achieves an AUROC of 0.91, demonstrating high predictive accuracy. Patients with 0-1 predictors had a 98.6% chance of no CDL, while those with all 3 predictors had a 77.8% probability of CDL, suggesting a more targeted approach to preoperative evaluation.

The study challenges the reliability of ASGE guidelines, which resulted in 42.4% of unnecessary ERCPs and 62.6% of patients being incorrectly referred for further testing. Unlike ASGE's broad criteria, which over-refer ACC patients, the new model provides a refined approach, allowing for direct cholecystectomy in low-risk patients (0-1 predictors), MRCP or EUS for intermediate-risk cases (2 predictors), and preoperative ERCP for high-risk patients (3 predictors). This strategy minimizes unnecessary invasive procedures, reducing patient risk and healthcare costs, while ensuring timely intervention for those with high CDL likelihood.

While the study presents a more efficient and targeted predictive model, it has limitations, including its retrospective design and single-centre data, which may not be generalizable across different settings. Additionally, long-term outcomes of CDL cases were not assessed, and practice variations among institutions could affect the implementation of the proposed algorithm. Despite these drawbacks, the study provides a strong foundation for revising existing guidelines, emphasizing the need for prospective validation to confirm clinical benefits and refine the model for broader application.

MATERIAL AND METHODOLOGY

PLACE OF STUDY: Department of General Surgery, Santosh Medical College & Hospital, Ghaziabad.

STUDY DESIGN: Hospital based observational study.

SAMPLE SIZE: 196

$$\text{Sample size } n = [DEFF*Np(1-p)] / [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$$

Population size(for finite population correction factor or fpc)(*N*):	1000000
Hypothesized % frequency of outcome factor in the population (*p*):	15%+/-5
Confidence limits as % of 100(absolute +/- %)(*d*):	5%
Design effect (for cluster surveys-*DEFF*):	1

STUDY DURATION- 1 year (Sept 2023 to Sept 2024)

STUDY TECHNIQUE: Hospital based Observational Study

INCLUSION CRITERIA:

All patients with preoperative clinical diagnosis of cholecystitis between age of 18years and 60years.

EXCLUSION CRITERIA:

- Asymptomatic cholelithiasis
- Gallstone induced pancreatitis.
- Acalculous cholecystitis
- Gall Bladder Malignancy
- Patients who refused to be part of the study.

STUDY TOOLS:

- History

- Clinical examination
- Radiological investigations
- Laboratory investigations
- Intraoperative findings

METHODOLOGY:

After taking the required consent, patients were assessed under following (Annexure 1)

- **Preoperative parameters:**

1) History parameters:
   - Age
   - Gender
   - History of cholecystitis
   - Comorbidities

2) Clinical parameters:
   - BMI
   - Per abdomen examination

3) Radiological parameters:
   - Gall bladder status
   - Size of gallbladder stones
   - CBD diameter on USG/MRCP/CT/ERCP
   - CBD Stone
   - USG Findings

4) Biochemical parameters:
   - Total leucocyte count
   - Serum alkaline phosphatase
   - SGOT
   - SGPT
   - Total Bilirubin
   - PTINR
   - PLT
   - Lipase
   - Albumin
   - GGTP

- **Intraoperative findings and procedure undergone.**

The patients were assessed preoperatively then later divided into 2 Groups –

1- Patient with choledocholithiasis
2- Patients without choledocholithiasis

The patient's further management was assessed on the following algorithm-

CATEGORY	PREDICTORS
Very Strong	CBD stone on transabdominal US
	Clinical ascending cholangitis
	Bilirubin >4 mg/dL
Strong	Dilated CBD on US (>6 mm with gallbladder in situ)
	Bilirubin level 1.8–4 mg/dL
Moderate	Abnormal liver biochemical test other than bilirubin
	Age older than 55 years
	Clinical gallstone pancreatitis
CRITERIA	**LIKELIHOOD**
Presence of a very strong predictor	High
Presence of both strong predictors	High
No predictors present	Low
All other patients	Intermediate

IF LOW TO MODERATE- LAP/SOS OPEN CHOLECYSTECTOMY

IF STRONG- MRCP

IF VERY STRONG- ERCP REFERAL/ OPEN CHOLEDOCHOTOMY

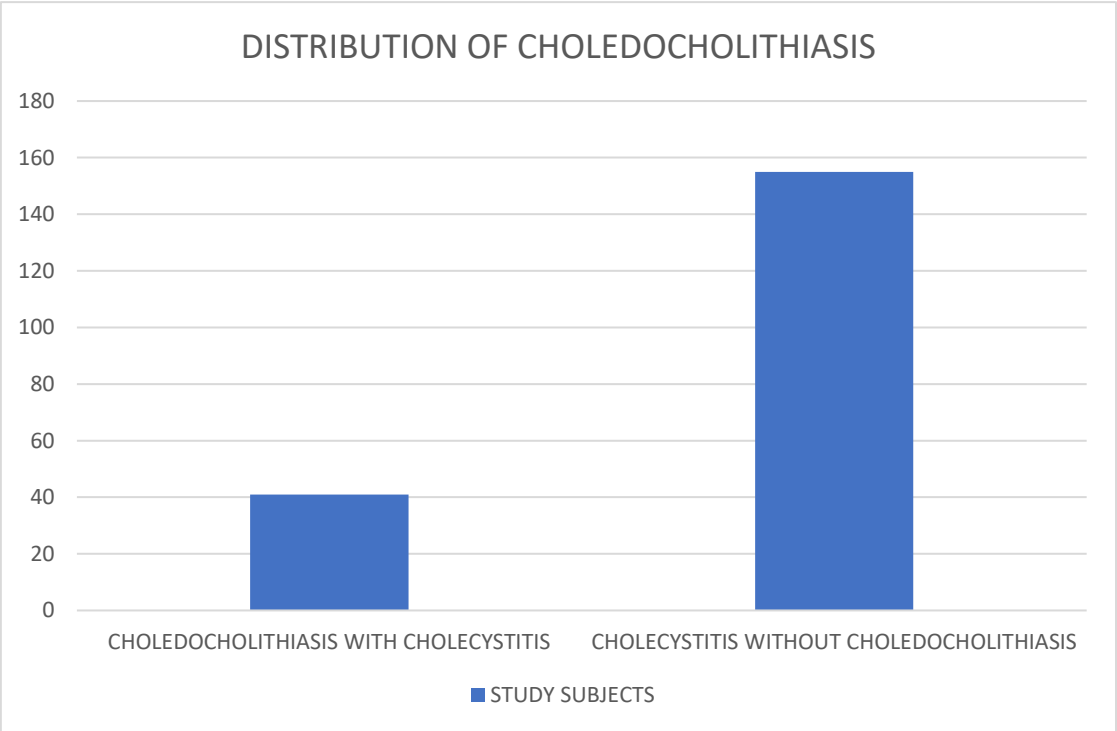
DATA MANAGEMENT AND ANALYSIS: The data was collected and entered in MS Excel 2010. We used Stata MP-17 to perform different statistical analyses. We employed the one-sample Kolmogorov–Smirnov test to determine whether the data sets differed from a normal distribution or not. If the data was normally distributed, we analyzed it using parametric tests. For non-normally distributed data, we used nonparametric tests. Descriptive statistics were calculated for qualitative and categorical variables. We created graphical representations of the variables to understand the results clearly and measure the association for categorical datasets using the Chi-Square test. We applied the independent T-test or student t-test to measure the mean difference between two groups. Correlation was estimated to measure the strength of the relationship between two or more quantitative variables. If the p-value was less than 0.05, we considered it statistically significant. If the p-value was greater than 0.05, we considered it statistically insignificant.

RESULTS

Table 1: Distribution of Choledocholithiasis in Patient Presenting with Cholecystitis

CATEGORY	FREQUENCY	% OF TOTAL
CHOLECYSTITIS WITH CHOLEDOCHOLITHIASIS	41	20.91
CHOLECYSTITIS WITHOUT CHOLEDOCHOLITHIASIS	155	79.08
TOTAL	**196**	**100**

Table 1 stated the distribution of choledocholithiasis in population diagnosed with acute cholecystitis, 41 patients (20.9%) were found to have coexisting choledocholithiasis out of total 196 subjects.

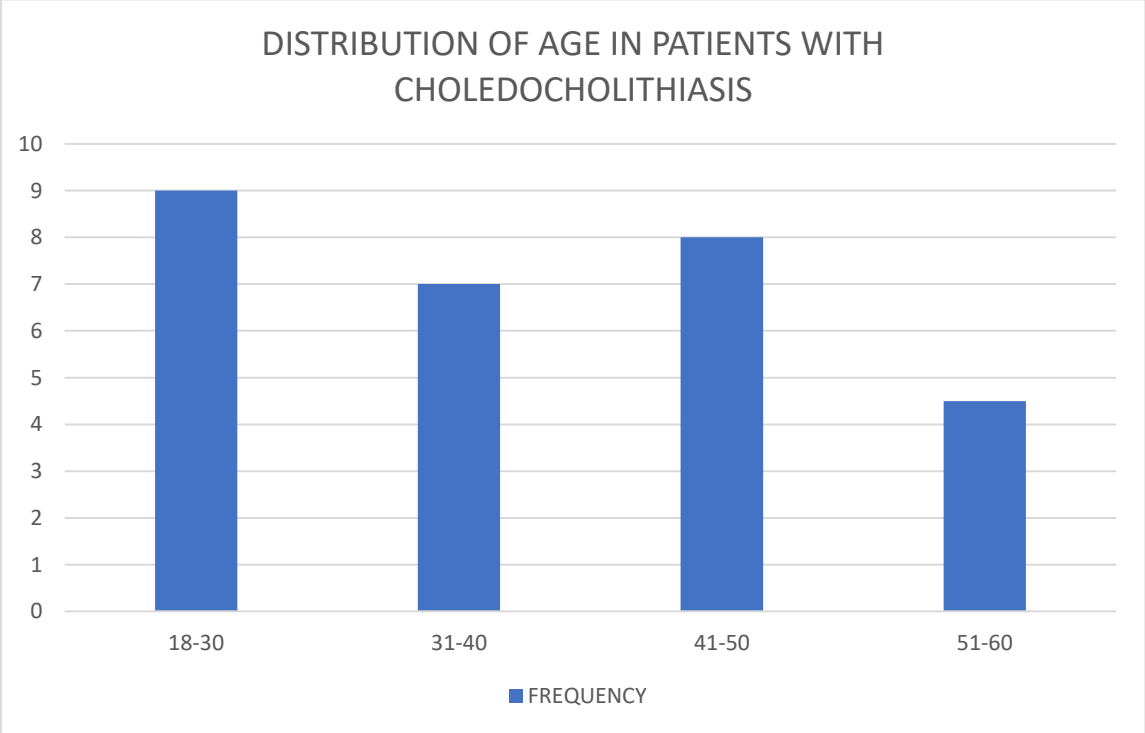


Graph 1: "Distribution of Choledocholithiasis in Patient Presenting with Cholecystitis"

Table 2: Distribution of Age Status in Patients with Choledocholithiasis

AGE	Frequency	% of Total
18-30	9	21.9%
31-40	7	17 %
41-50	8	19.5 %
51-60	17	41.4 %
Total	**41**	**100%**

Table 2 demonstrates a marked skew in age distribution toward older patients, with the highest prevalence (41.4%) observed in the 51–60-year age group, while the 31–40-year group shows the lowest representation at 17%. This trend indicates a higher susceptibility to choledocholithiasis in older age groups.

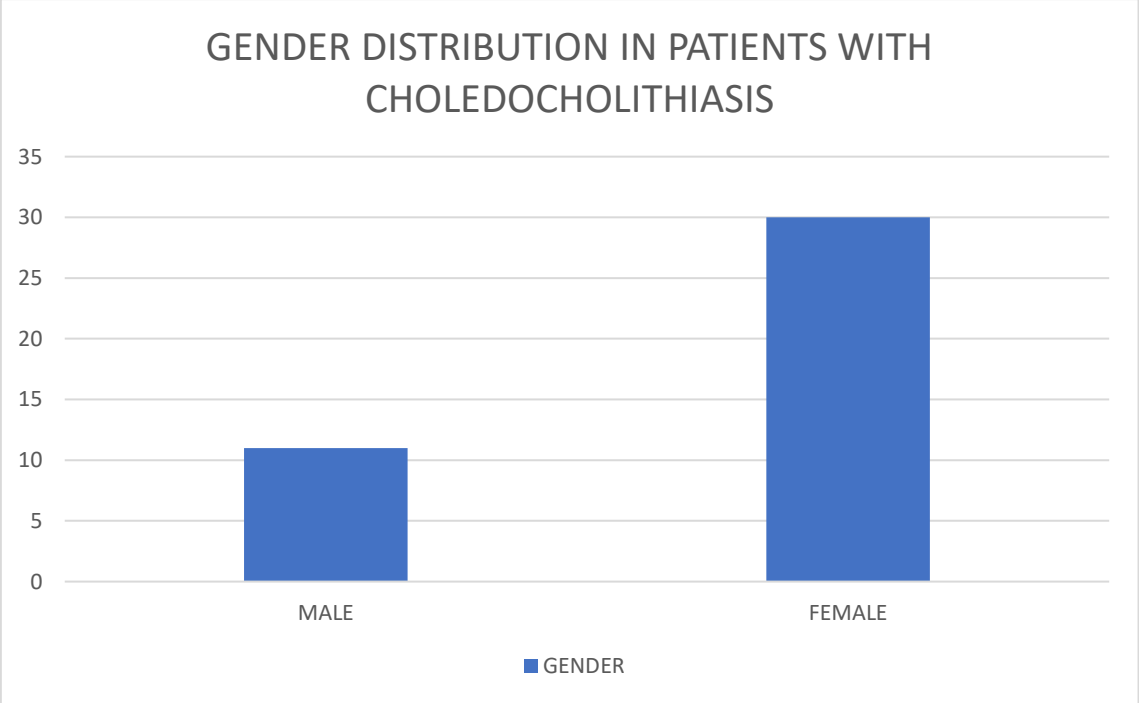


Graph 2: "Distribution of Age Status in Patients with Choledocholithiasis"

Table 3: Distribution of Gender Status in Patients with Choledocholithiasis

Gender	Frequency	% of Total
Male	11	26.8 %
Female	30	73.1 %
Total	41	**100%**

Table 3 indicates a pronounced gender disparity, with females comprising 73.1% of the cohort and males only 26.8%. This reflects the well-documented higher prevalence of cholecystitis and gallstone-related disorders among women.

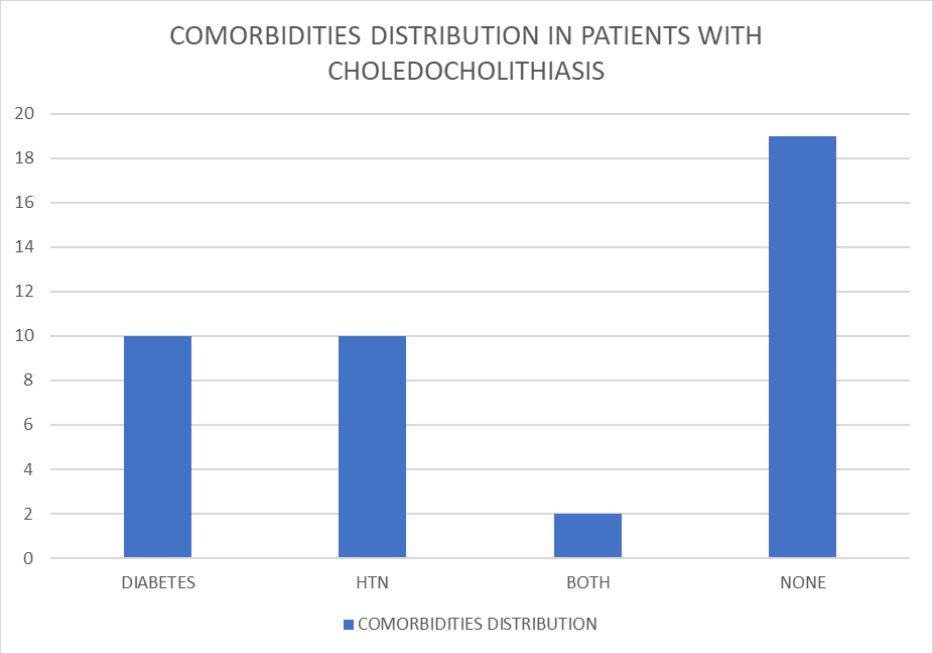


Graph 3: "Distribution of Gender Status in Patients with Choledocholithiasis

Table 4: Distribution of Comorbidities Status in Patients with Choledocholithiasis

COMORBIDITIES	Frequency	% of Total
DIABETES	10	**24.3%**
HTN	10	**24.3%**
BOTH	2	4.8%
NONE	19	46.3%
Total	41	**100%**

Table 4 highlights the data on comorbidities indicates that 46.3% of individuals have no underlying conditions, while 24.3% have diabetes, an equal proportion of 24.3% have hypertension (HTN), and 4.8% present with both conditions. This distribution highlights that 53.7% of the population has at least one comorbidity, which may have significant implications for disease progression, management, and treatment outcomes, particularly in relation to conditions such as cholecystitis.

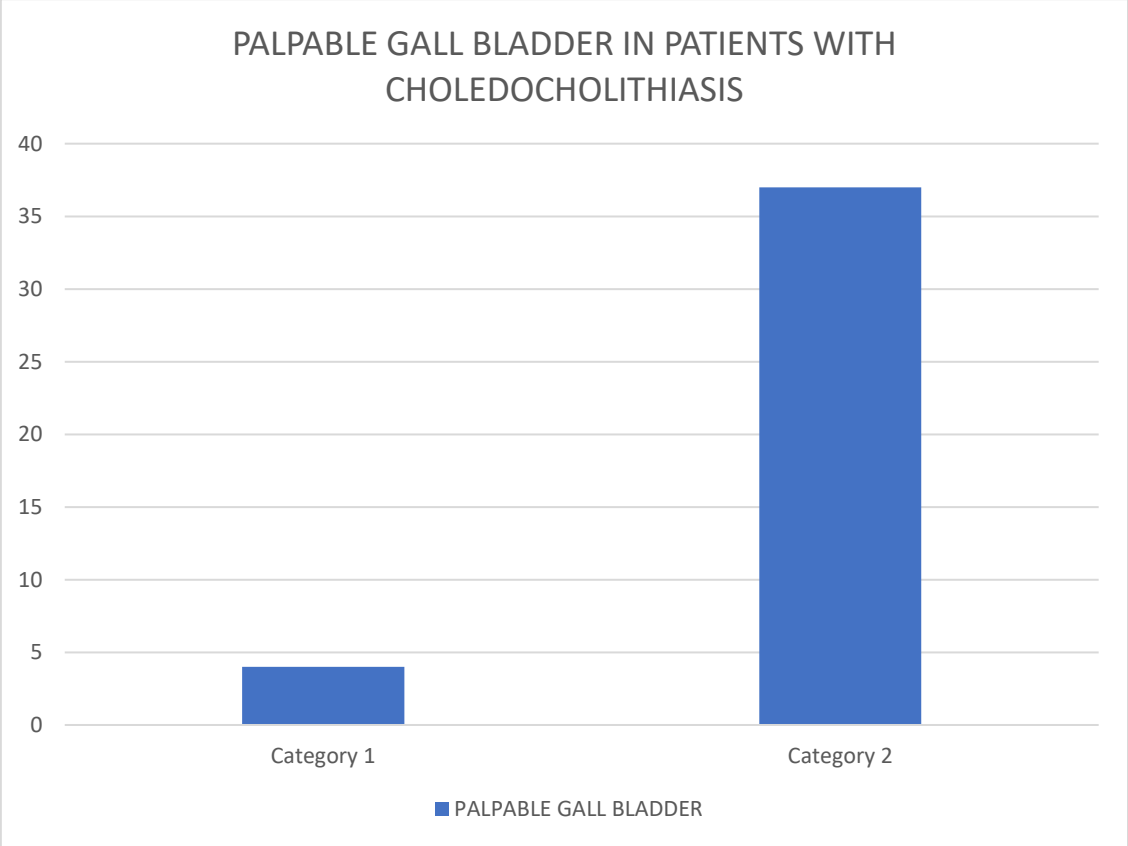


Graph 4: "Distribution of comorbidities Status in Patients with Choledocholithiasis"

Table 5: Distribution of Palpable Gallbladder Status in Patients with Choledocholithiasis

PALPABLE GALLBLADDER	Frequency	% of Total
Yes	4	9.7 %
No	37	90.2 %
Total	41	**100%**

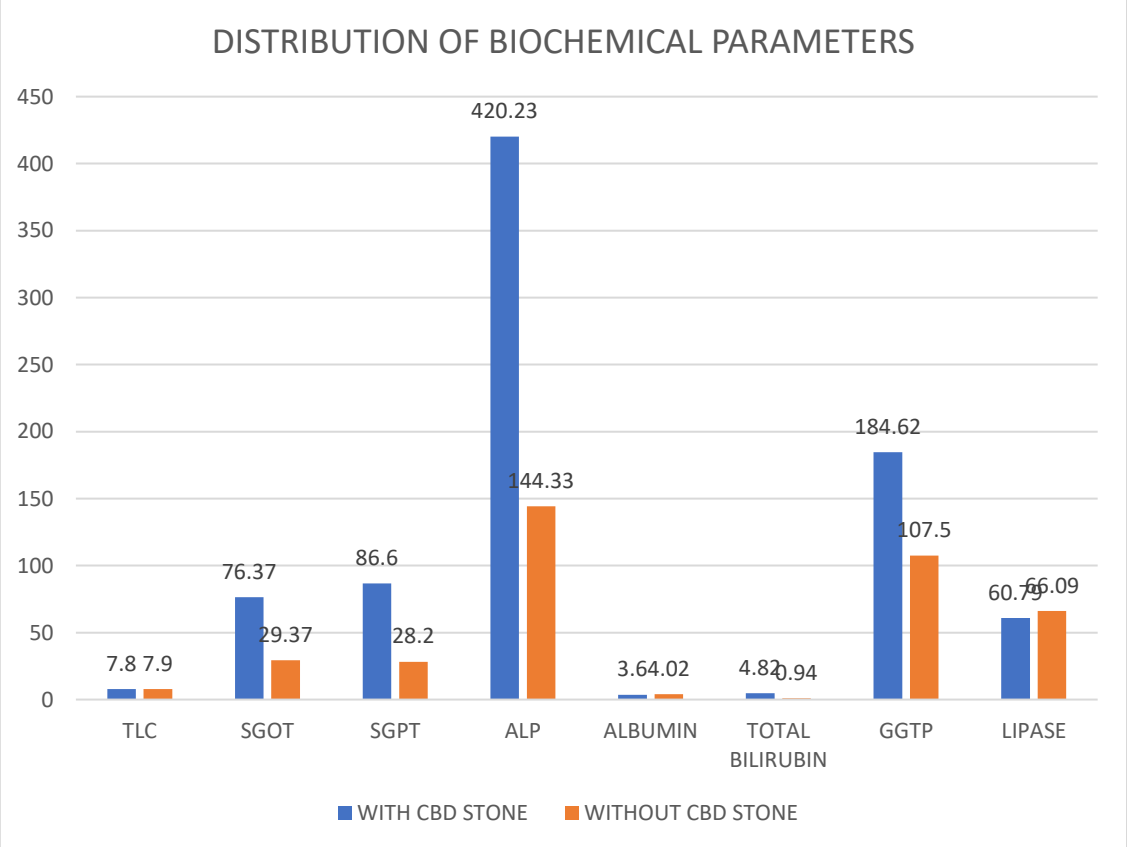
Table 5 shows that the data on palpable gallbladder indicates that only 9.7% of individuals (4 cases) presented with a palpable gallbladder, while the majority, 90.2% (37 cases), did not. This suggests that gallbladder enlargement is relatively uncommon in this population.



Graph 5: "Distribution of Palpable Gallbladder Status in Patients with Choledocholithiasis"

Table 6: Distribution of Biochemical Parameters in patients With and Without Choledocholithiasis

BIOCHEMICAL PARAMETERS	WITH CBD STONE (Mean ± SD)	WITHOUT CBD STONE (Mean ± SD)	P value
TLC	7819.93 ± 3501.59	7927.95 ± 2456.47	0.8
SGOT	76.37 ± 64.4	29.37 ± 11.94	0
SGPT	86.6 ± 63.66	28.2 ± 16.2	0
ALP	420.23 ± 286.5	144.33 ± 46.31	0
ALBUMIN	3.6 ± 0.57	4.02 ± 0.33	0
TOTAL BILIRUBIN	4.82 ± 025	0.94 ± 0.14	0
GGTP	184.62 ± 198.17	107.5 ± 43.42	0.01
LIPASE	60.79 ± 54.19	66.09 ± 33.79	0.55



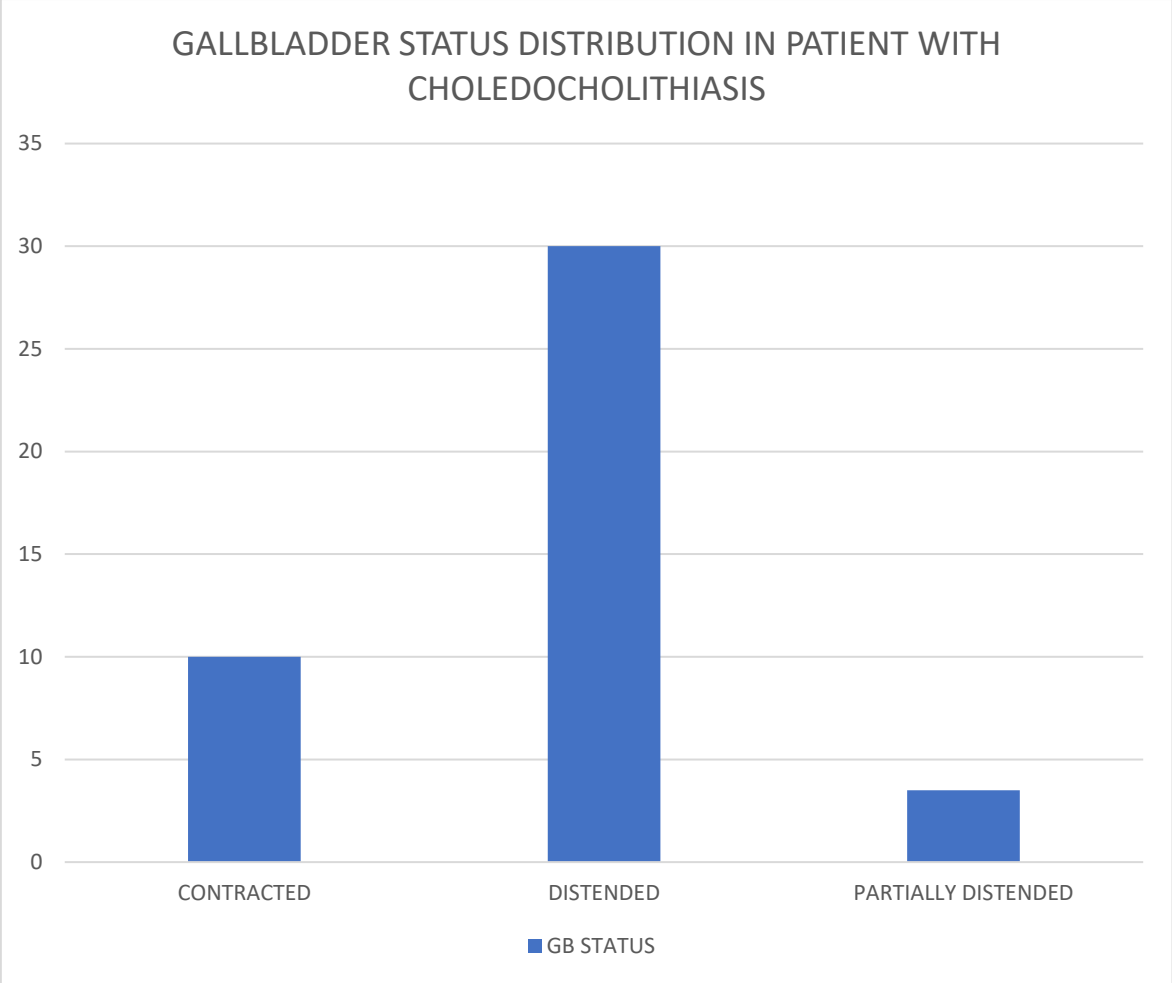
Graph 6: Distribution of Biochemical Parameters in Patients With and Without Choledocholithiasis

Table 6 suggests that patients with choledocholithiasis showed significantly higher levels of SGOT, SGPT, ALP, total bilirubin, and GGTP ($p < 0.005$), indicating hepatocellular injury and cholestasis. Albumin levels were significantly lower ($p < 0.0001$), possibly reflecting systemic inflammation. In contrast, TLC and lipase did not differ significantly between groups ($p = 0.8533$ and $p = 0.4784$, respectively), suggesting limited diagnostic value.

Table 7: Distribution of Gallbladder (GB) Status in Patients with Choledocholithiasis in patients presenting with cholecystitis

GB STATUS	**Frequency**	**% of Total**
CONTRACTED	10	24.3 %
DISTENDED	30	73.1 %
PARTIALLY DISTENDED	1	2.4 %
Total	41	**100%**

Table 7 outlines gallbladder status, revealing that 73.1% of patients presented with gallbladder distension, indicative of acute biliary obstruction. In contrast, 24.3% had a contracted gallbladder, suggestive of chronic inflammation or previous episodes, while 2.4% exhibited partial distension.

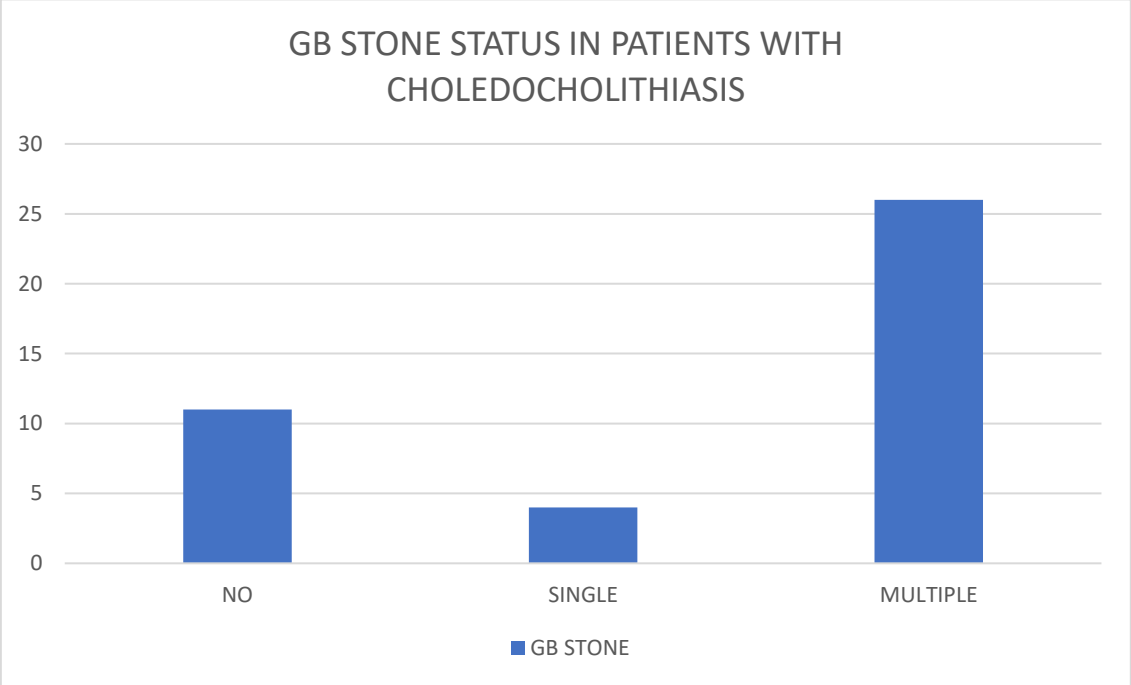


Graph 7: "Distribution of Gallbladder (GB) Status in Patients with Choledocholithiasis"

Table 8: Distribution of Gallbladder (GB) Stones Status in Patients with Choledocholithiasis

GB STONE	Frequency	% of Total
NO	11	26.8 %
SINGLE	4	9.7%
MULTIPLE	26	63.4 %
Total	41	**100%**

Table 8 highlights that 63.4% had multiple GB calculi.

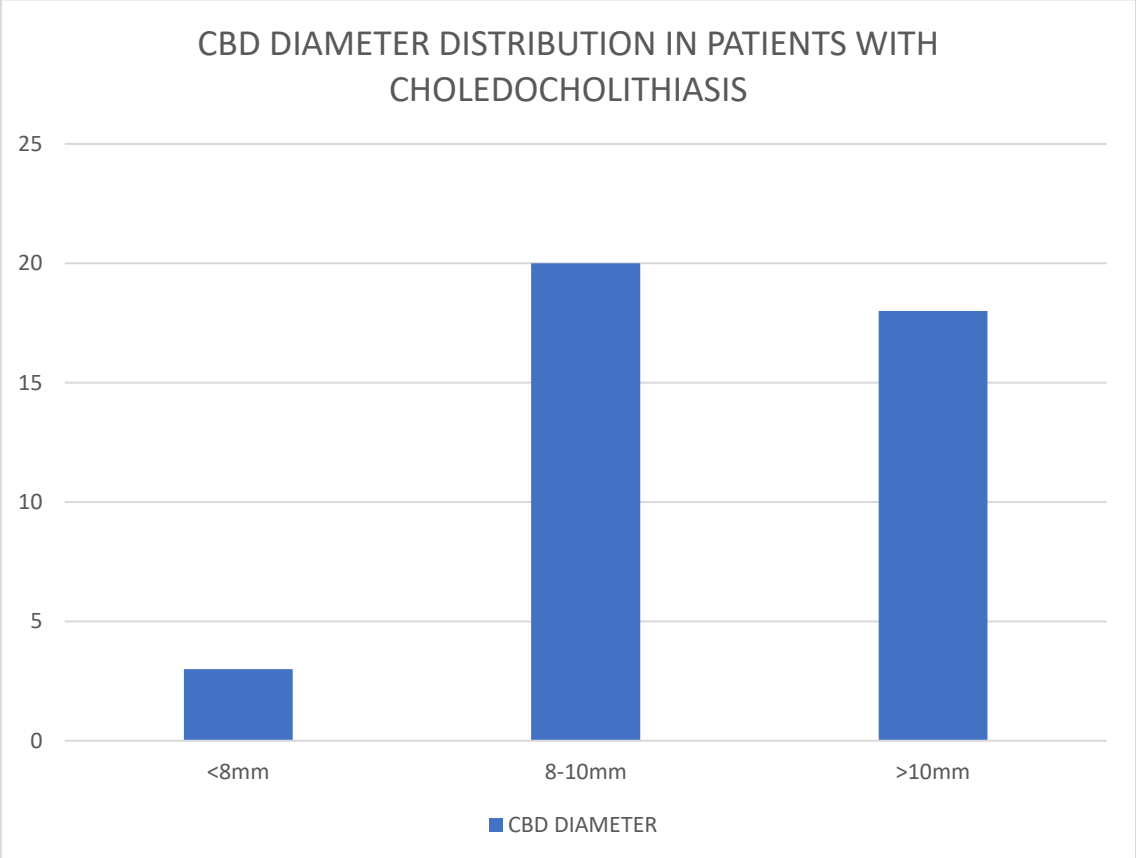


Graph 8: "Distribution of Gallbladder (GB) Stones Status in Patients with Choledocholithiasis"

Table 9: Distribution of CBD Diameter in Patients with Choledocholithiasis

CBD DIAMETER	FREQUENCY	% OF TOTAL
<8mm	3	7.3
8-10mm	20	48.7
>10mm	18	43.9
TOTAL	41	100%

Table 9 highlights CBD diameter among 41 patients shows that 48.7% had borderline dilatation (8–10 mm), while 7.3% had normal diameters (<8 mm), and only 43.9% showed significant dilatation (>10 mm).

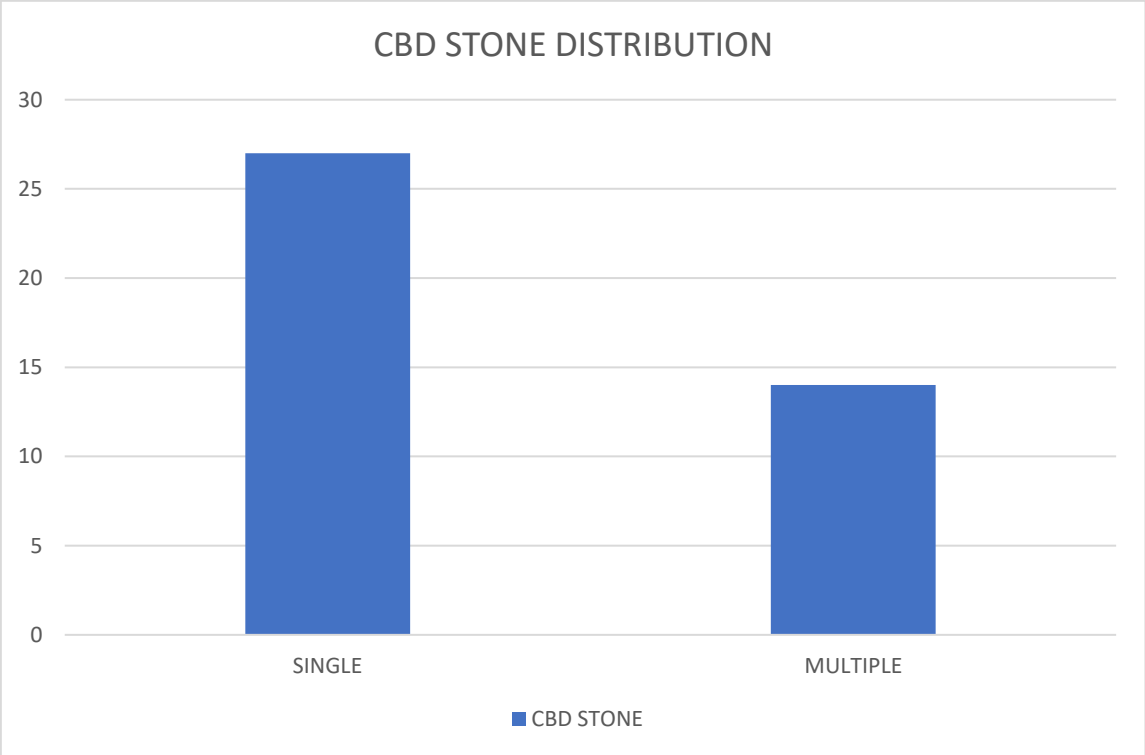


Graph 9: Distribution of CBD Diameter in Patients with Choledocholithiasis

Table 10: Distribution of CBD Stones

CBD STONE	Frequency	% of Total
SINGLE	27	65.8 %
MULTIPLE	14	34.1%
Total	41	**100%**

Table 10 highlights the data on common bile duct (CBD) stones reveals that the majority of cases, 65.8% (27 individuals), had a single CBD stone, while 34.1% (14 individuals).



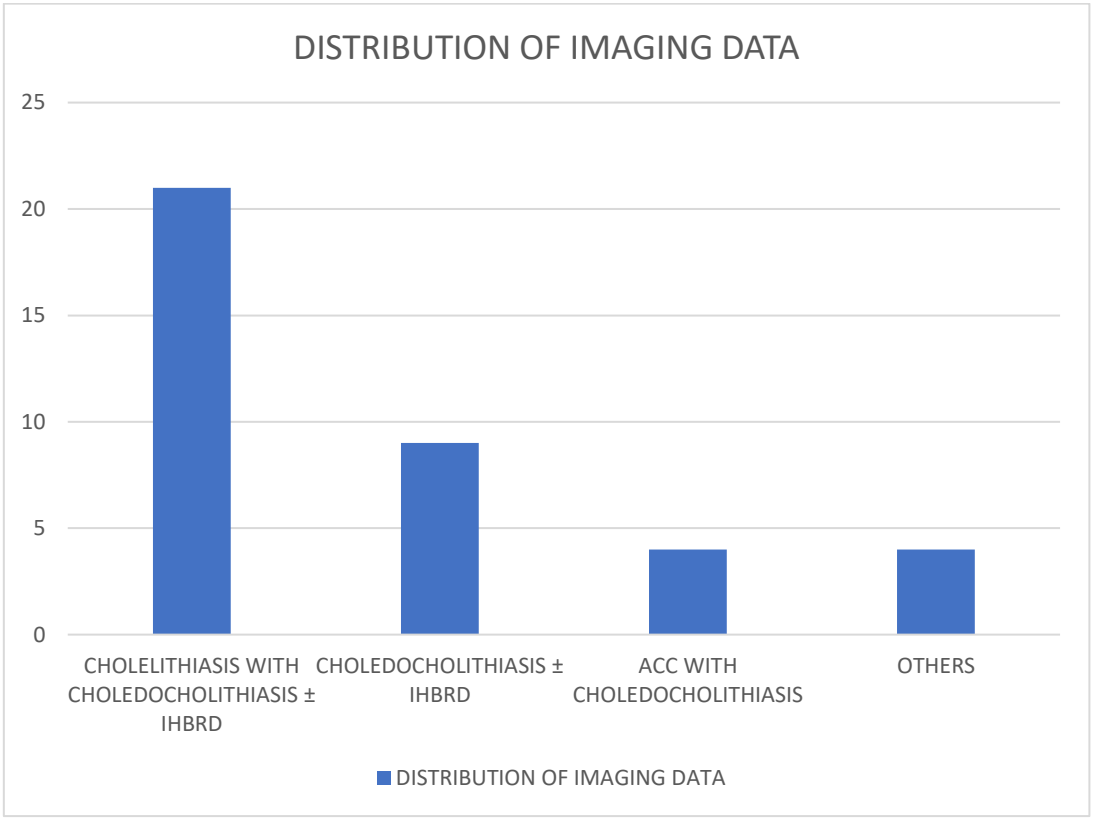
Graph 10: "Distribution of CBD Stones"

Table 11: Distribution of Findings on USG/MRCP/ERCP/CT

	Frequency	% of Total
CHOLELITHIASIS WITH CHOLEDOCHOLITHIASIS	10	24.39
CHOLELITHIASIS WITH CHOLEDOCHOLITHIASIS WITH IHBRD	7	17.07
CHOLEDOCHOLITHIASIS	4	9.7
CHOLELITHIASIS WITH DILATED CBD	3	7.31
ACUTE CALCULUS CHOLECYSTITIS WITH CHOLEDOCHOLITHIASIS WITH P/O MIRIZZI'S SYNDROME	2	4.8
CHOLELITHIASIS WITH CHOLEDOCHOLITHIASIS WITH CENTRAL IHBRD	2	4.8
ACUTE CALCULOUS CHOLECYSTITIS WITH DILATED CBD	2	4.8
GB SLUDGE WITH CHOLEDOCHOLITHIASIS	2	4.8
CHOLELITHIASIS WITH DILATED CBD WITH CHOLEDOCOLITHIASIS	1	2.4
CHOLEDOCHOLITHIASIS WITH IHBRD	1	2.4
CHOLECYSTITIS WITH DILATED CBD STONE	1	2.4
CHOLLELITHIASIS WITH CHOLEDOCHOLITHIASIS	1	2.4
CHOLECYSTITIS WITH DILATED CBD? STONE? STRICTURE	1	2.4
CHOLEDOCHOLITHIASIS WITH DILATED CBD WITH BILOBAR IHBRD	1	2.4
CHOLEDOCHOLITHIASIS WITH DILATED CBD	1	2.4
CHOLELITHIASIS WITH DILATED CBD	1	2.4
CHOLEDOCHOLITHIASIS WITH CENTRAL IHBRD	1	2.4
Grand Total	**41**	**100**

±

Table 11 summarizes imaging findings among the 41 patients revealed that the most common diagnosis was cholelithiasis with choledocholithiasis, observed in 24.39% of cases, followed by cholelithiasis with choledocholithiasis and intrahepatic biliary radicle dilatation (IHBRD) in 17.07%. Isolated choledocholithiasis accounted for 9.7%, while combinations involving dilated common bile duct (CBD), sludge, or Mirizzi's syndrome were less frequent. Rare presentations included cholecystitis with suspected CBD stones or strictures and bilobar or central IHBRD, each constituting 2.4% of cases.

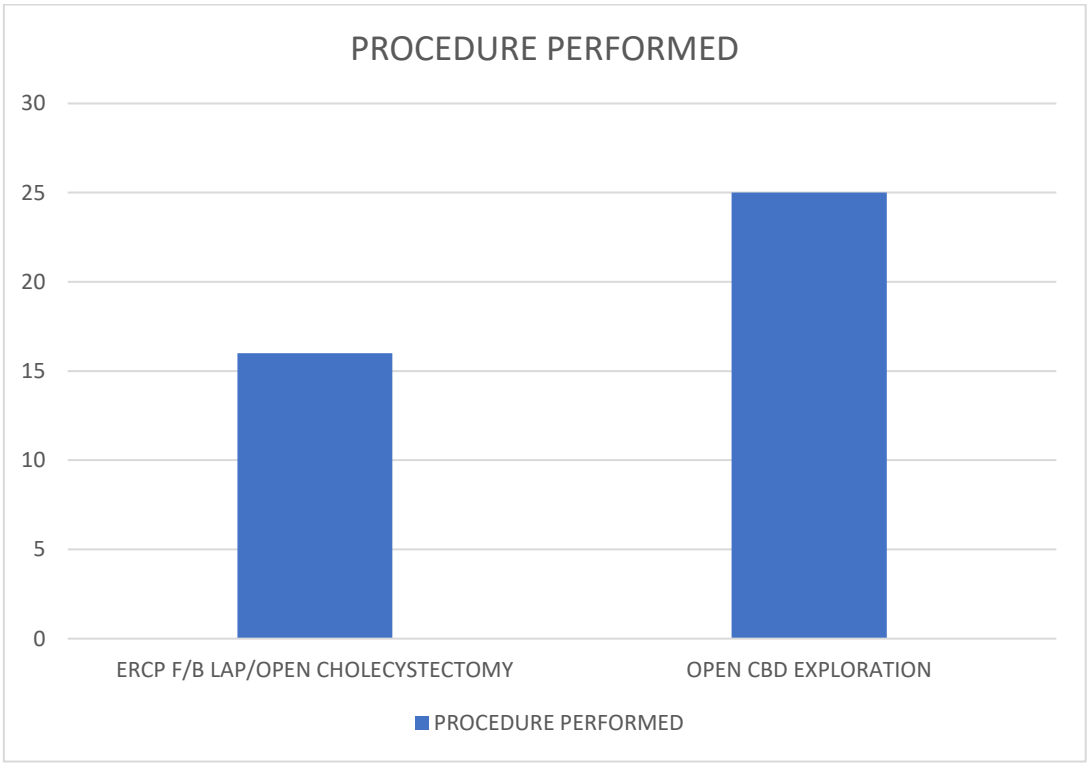


Graph 11: "Distribution of Findings on USG/MRCP/ERCP/CT"

Table 12: Distribution of Procedures Performed in Patients with Choledocholithiasis

PROCEDURE PERFORMED	Frequency	% of Total
ERCP F/B LAPAROSCOPIC/ SOS OPEN CHOLECYSTECTOMY	16	**39.02%**
OPEN CBD EXPLORATION	25	**60.97**
TOTAL	**41**	**100%**

Table 12 reveals that open common bile duct (CBD) exploration was the primary intervention, performed in 60.97% of cases, while ERCP F/b Lap/Open cholecystectomy was done in 39.1% cases.



Graph 12: "Distribution of Procedures Performed in Patients with Choledocholithiasis"

Table 13: Correlation Between USG/MRCP/ERCP/CT Findings, CBD Diameter, GGTP, and Lipase

Parameter 1	Parameter 2	Spearman's Rho (ρ)	Interpretation
CBD Diameter	GGTP	0.44	Moderate positive correlation (larger CBD linked with higher GGTP)
CBD Diameter	Lipase	-0.13	Weak negative correlation (minimal relationship between CBD and Lipase)
GGTP	Lipase	-0.08	Very weak negative correlation (GGTP and Lipase show no strong association)
Findings Encoded	Other Parameters	0.02	Minimal correlation between radiological findings and biochemical markers

Table 13 evaluates the Spearman's Rho correlation analysis highlights the relationships between USG/MRCP/ERCP findings, CBD diameter, GGTP, and lipase levels. A moderate positive correlation ($\rho = 0.44$) between CBD diameter and GGTP suggests that an increase in bile duct size is associated with higher GGTP levels, likely indicating bile duct obstruction. In contrast, CBD diameter and lipase levels show a weak negative correlation ($\rho = -0.13$), implying minimal association between duct size and pancreatic enzyme activity. Similarly, GGTP and lipase exhibit a very weak negative correlation ($\rho = -0.08$), suggesting little direct biochemical linkage. The numerically encoded USG/MRCP/ERCP findings have weak correlations ($\rho \approx 0.02 - 0.03$) with all biochemical parameters, indicating diverse radiological presentations without a strong statistical relationship. Overall, these findings emphasize that GGTP is more closely linked to bile duct diameter than lipase, while radiological findings do not strongly predict biochemical variations.

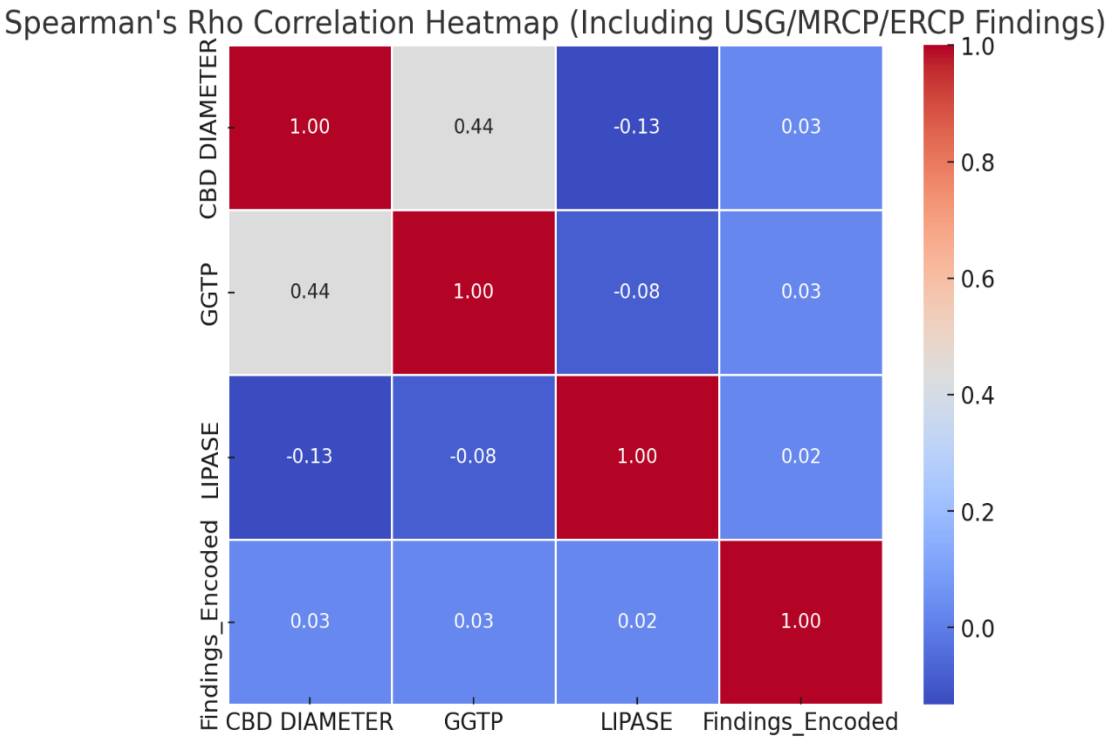


Figure 9: "Correlation Between USG/MRCP/ERCP/CT Findings, CBD Diameter, GGTP, and Lipase"

DISCUSSION

Acute calculus cholecystitis being the most common complication of symptomatic gallstones, in a significant proportion of patients with Acute calculous cholecystitis other complications, such as choledocholithiasis, cholangitis or biliary pancreatitis, may coexist.

In our study, choledocholithiasis was identified in 20.9% of patients presenting with acute cholecystitis, among the 196 subjects included. This aligns with the globally reported prevalence of 10–20%[40] and emphasizes the importance of routine evaluation for common bile duct (CBD) stones in this patient population. This substantial proportion highlights the need for clinicians to maintain a high index of suspicion, as early detection can prevent serious complications such as cholangitis and pancreatitis.

Comparatively, Chisholm et al. [39] identified choledocholithiasis in 65 out of 366 patients (17.8%), while Siddhartha et al.[37] reported 63 cases among 173 patients (36.4%) with cholecystitis, further reinforcing the significance of this condition across various cohorts.

A clear age-related trend was observed, with the majority (41.4%) of choledocholithiasis cases occurring in the 51–60 age group. Notably, over 60% of cases were in individuals older than 40 years, supporting the established association between advancing age and increased risk of biliary tract complications. This trend is consistent with the natural history of gallstone disease, where older individuals are more prone to stone migration and ductal obstruction.

Comparable findings were noted in other studies, with Gouveia et al.[38] reporting a mean age of 68 years, Siddhartha et al.[37] 49.89 years, and Chisholm et al.[39] 52 years.

Females constituted 73.1% of the choledocholithiasis group in our study, consistent with the well-documented female predisposition to biliary diseases. The influence of estrogen and progesterone on bile composition and gallbladder motility may explain this increased risk. However, other studies by Gouveia et al. [38], Siddhartha et al. [37], and Chisholm et al. [39] reported a predominance of male patients with choledocholithiasis, suggesting potential geographic or population-based variations in gender distribution.

More than half (53.7%) of the patients had comorbid conditions, with diabetes mellitus and hypertension being the most common. These comorbidities may impair gallbladder

contractility, promote bile stasis, and contribute to chronic inflammation, thereby increasing the risk of gallstone formation and migration. These findings suggest that patients with metabolic syndrome warrant closer surveillance for biliary complications.

Only 9.7% of patients presented with a palpable gallbladder, underscoring the limited reliability of physical examination in diagnosing gallbladder pathology. Imaging remains the gold standard for assessing gallbladder morphology and should be prioritized.

A distended gallbladder was noted in 73.1% of patients, typically indicative of acute biliary obstruction or cystic duct blockage. In contrast, contracted gallbladders (24.3%) suggest chronic inflammatory changes or prior cholecystitis episodes, indicating a mixed clinical presentation of acute and chronic pathology.

Multiple gallstones were found in 63.4% of cases, supporting the hypothesis of chronic calculous disease and an increased risk of CBD stone migration.

CBD dilatation was observed in most patients, with 48.7% having diameters between 8–10 mm, and 43.9% exhibiting >10 mm. Only 7.3% had a CBD diameter <8 mm. These findings indicate that ductal dilatation is a common feature in choledocholithiasis, although early cases may still fall within normal limits. Therefore, CBD diameter should be interpreted in conjunction with biochemical and clinical findings to avoid underdiagnosis.

Single CBD stones were more common (65.8%) than multiple stones (34.1%). While solitary stones may be easier to manage, they are still capable of causing significant clinical consequences if undetected.

Patients with choledocholithiasis exhibited significantly elevated levels of liver enzymes (SGOT, SGPT, ALP), gamma-glutamyl transferase (GGTP), and total bilirubin, consistent with hepatocellular injury and cholestasis. In contrast, serum albumin levels remained stable, indicating preserved synthetic liver function.

The most frequent radiological patterns were cholelithiasis with choledocholithiasis (24.4%) and choledocholithiasis with intrahepatic biliary radicle dilatation (17.1%). These presentations reflect the complexity of diagnosis and the necessity for multimodal imaging. Less common conditions, such as Mirizzi’s syndrome and biliary strictures,

highlight the spectrum of disease and the need for tailored evaluation. These trends are consistent with findings from Chisholm et al.[39], Siddhartha et al.[37], Gouveia et al.[38], and Yuen et al.[35], who also reported significant elevations in ALP and bilirubin in choledocholithiasis cases.

Open CBD exploration was performed in 60.97% of patients, likely due to factors such as large stone burden, anatomical anomalies, or failed endoscopic attempts. Endoscopic retrograde cholangiopancreatography (ERCP) followed by laparoscopic or open cholecystectomy was conducted in 39.02%, illustrating the role of minimally invasive techniques in select cases.

A moderate positive correlation ($r = 0.44$) was observed between CBD diameter and GGTP, suggesting that GGTP can serve as a useful predictor of biliary obstruction. Weak correlations between CBD diameter and lipase, and between GGTP and lipase, imply that lipase is less reliable for diagnosing choledocholithiasis. Furthermore, the minimal correlation between radiological and biochemical parameters highlights the need for an integrated diagnostic approach.

SUMMARY

This study identified choledocholithiasis in 20.9% of patients with acute cholecystitis, a figure consistent with global estimates, reaffirming the importance of routine evaluation for CBD stones in this population. A strong age-related pattern was observed, with the majority of cases occurring in individuals over 40, particularly within the 51–60 age group. Females constituted a significant proportion (73.1%) of the choledocholithiasis group, although previous studies showed variable gender distribution. Comorbidities, especially diabetes and hypertension, were prevalent and may contribute to increased risk.

Radiological findings revealed that distended gallbladders and multiple gallstones were common, supporting the chronic nature of the disease in many patients. Most cases showed CBD dilatation, and single CBD stones were more prevalent than multiple stones. A notable proportion presented with combined radiological features such as intrahepatic biliary radicle dilatation and gallstones, emphasizing the diagnostic complexity.

Biochemically, choledocholithiasis was associated with elevated liver enzymes (SGOT, SGPT, ALP), GGTP, and total bilirubin, with a moderate correlation found between CBD diameter and GGTP levels. These findings support the utility of liver function tests in the early identification of biliary obstruction. However, the lack of strong correlation between radiological and biochemical parameters indicates the need for a comprehensive, multimodal diagnostic approach.

Surgically, open CBD exploration remained the predominant intervention, though ERCP followed by cholecystectomy was successfully employed in selected patients.

CONCLUSION

Choledocholithiasis is a frequent and clinically significant finding among patients with acute cholecystitis. Early identification through integrated clinical, biochemical, and radiological evaluation is critical for optimizing management and preventing complications. The study also highlights the impact of age, gender, comorbidities, biochemical parameters and imaging findings on disease presentation and outcomes, underscoring the need for individualized patient assessment and tailored intervention strategies.

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PROFORMA

Serial No.: Date:

Name: Age/Sex:

IPD no.: Address:

Final Diagnosis: Date of surgery:

Treatment Plan:

History:

History of cholecystitis: Comorbidities:

Clinical

BMI:

PER ABDOMEN FINDINGS

Radiological:

GB status: GB wall thickness:

GB stone size: CBD Diameter:

CBD stone:

Biochemical

TLC: ALBUMIN

SGOT

SGPT ALP PLT

LIPASE

Procedure perfomed and Intraoperative findings

SANTOSH MEDICAL COLLEGE AND HOSPITAL (GHAZIABAD)

INFORMED CONSENT

I _____ Son/Daughter/Wife of _____ resident of _____hereby declare that I give my full, free and voluntary informed consent in the thesis - "**Predictors of choledocholithiasis in patients presenting with Cholecystitis**". Dr._____ has informed me to my full satisfaction, in the language I understand, about the purpose, nature of study and various laboratory investigations for the study to be carried out. I have been informed about the duration of the study and instructions to be followed during the study period.

I give full consent for being enrolled in the above study and I reserve my rights to withdraw from this study, whenever I wish without prejudice of my right to undergo further treatment at Santosh Hospital, Ghaziabad U.P.

Patient's/ Patient's relative's signature Or thumb impression

Doctors signature

Name:

Date:

We have witnessed that the patient signed the above form in the presence of his free will after fully understanding its content.

Signature of Witness

Name

Signature of Investigator
Name: Dr. Abhinav Patel
Designation: PG Department of General Surgery
Contact No.- 9651506651

संतोष मेडिकल कॉलेज एवं अस्पताल (गाजियाबाद)

<u>सहमति पत्र (सूचित)</u>

मैं _____ बेटा/ बेटी/ पत्नी_____निवासी _____ घोषणा करता हूं कि डॉ ._____, ने मुझे मेरी भाषा में अपने अध्ययन "**Predictors of choledocholithiasis in patients presenting with Cholecystitis**" के उद्देश्य के बारे में, और अध्ययन के दौरान अपनाई जाने वाली विभिन्न प्रयोगशाला जांच के बारे में सूचित कर दिया है। मुझे अध्ययनकी अवधि और उसके दौरान अपनाए जाने वाले निर्देश भी मेरी भाषा मे समझा दिए गए हैं| मैं उपरोक्त अध्ययन में बिना किसी दबाव के दाखिला ले रहा हूं और पूर्ण सहमति दे रहा हूं | सन्तोष अस्पताल, गाजियाबाद में अपने आगे के उपचार पर बिना प्रतिकूल प्रभाव डाले इस अध्ययन से और प्रयोगशाला जांच की प्रकृति से मैं जब चाहूँ बाहर जाने के अपने अधिकार को सुरक्षित रख रहा हूं |

रोगी / रोगी के रिश्तेदार के हस्ताक्षर डॉक्टर के हस्ताक्षर

नाम

दिनांक:

मेरी उपस्थिति में मरीज ने पूरी तरह से डाकटर के बताए गए अध्ययन और निर्देशों को समझने के बादअपनी स्वतंत्र इच्छा से ऊपर के फार्म पर हस्ताक्षर किए हैं ।

हस्ताक्षर

नाम: डॉ अभिनव पटेल

पदनाम: पीजी

शल्य चिकित्सा विभाग

संपर्क नंबर- 9651506651

Details of Patient Information Sheet
Human Subject Research Proposal

1) Identifying Data
Name of Researcher: Dr. Abhinav Patel
Department: Department of General Surgery
Title of Project**: Predictors of choledocholithiasis in patients presenting with Cholecystitis**

2) Description of Human Subjects Safeguards and Rights:
A) Possible psychological or physical risk or discomfort, involved in research
Yes □ NO □ (if no, skip item B)
If yes, answer the following
Why necessary?

1. To have the common disease
2. Specificity and sensitivity of the treatment

B) Make sure the following questions are answered in your research proposal on collection of Data:
1) When will it take place?
……
2) What length of time needed for complete examination of the patient?
Approx 1 hour.
3) What period of time needed?
Approx 1 year.
4) Which specific place within institution?
Department of Surgery.
5) How much population required including number of subjects?
6) Name of instrument to be used for data collection?
Pre-operative parameters for predicting difficult laparoscopic cholecystectomy.
7) Methodology to be used (write details)?

- A detailed history of all patients will be taken and a thorough clinical examination will be done. All patients will be analyzed in various aspects like age, sex, body weight, BMI, History of cholecystitis, per abdomen findings, , comorbidities, and radiology-based evidence.
- Pre-operative routine investigations like Blood including TLC, ALP,SGOT,SGPT,ALBUMIN,GGTP,LIPASE,PLT and USG will be done and their relation with presence of cbd stone in cholecystitis patient will be assessed.
- The analyzed data will be compared with other series in literature and discussed. A master chart dealing with all aspects will be designed and presented. A proforma will be used for the study purpose.

C) Will Subjects be given research results if they so request?
Yes □ No □

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F. No. SU/R/2023/2489[41] Dated: 26.09.2023

Subject: Grant of Ethical Clearance for **Thesis Protocol** Topic **"PREDICTORS OF CHOLEDOCHOLITHIASIS IN PATIENTS PRESENTING WITH CHOLECYSTITIS",** submitted by **Dr. ABHINAV PATEL,** MD/MS student of Batch 2022-2023, Department of **GENERAL SURGERY**.

*****

With reference to his/her request for grant of Ethical Clearance for the Thesis Protocol entitled **"PREDICTORS OF CHOLEDOCHOLITHIASIS IN PATIENTS PRESENTING WITH CHOLECYSTITIS", Dr. ABHINAV PATEL** is informed that the **Thesis Protocol** submitted by him/her was considered by the **Screening Committee** of the Santosh Medical College & Hospital in its meetings held on 17.07.2023 to 28.07.2023. The recommendations of the **Screening Committee** were considered in detail by the **Institutional Ethics Committee** in its meeting held on **23.09.2023** and the same was **approved** by the **Ethics Committee**.

He /She is informed accordingly for further necessary action.

[Dr. NARESH SHARMA]
REGISTRAR

SANTOSH "DEEMED TO BE UNIVERSITY" REGISTRAR GHAZIABAD, NCR DELHI

Dr. ABHINAV PATEL
MD/MS student of batch 2022-2023
Department of GENERAL SURGERY
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5. The Director - IQAC
6. Dr. Tripta S Bhagat (Guide)
7. HOD of GENERAL SURGERY

PLAGIARISM CHECK CERTIFICATE

Dr.Abhinav Patel

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